

**REPORT NO. 208-MGA-2014-DC017**

**DUMMY PERFORMANCE CALIBRATIONS  
FMVSS 208**

**DAIMLER AG STUTTGART  
2014 MERCEDES-BENZ CLA250 PASSENGER CAR  
NHTSA NO.: C20144302**

**PREPARED BY:  
MGA RESEARCH CORPORATION  
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BURLINGTON, WI 53105**



**TEST DATES: AUGUST 14, 2014 – SEPTEMBER 29, 2014**

**FINAL REPORT DATE: DECEMBER 4, 2014**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF ENFORCEMENT  
OFFICE OF VEHICLE SAFETY COMPLIANCE  
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## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #124, PART 572, SUBPART O EXTERNAL DIMENSIONS |                                |                                                                                                                                              |                         |                    |
|-----------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                   | DESCRIPTION                    | DETAILS                                                                                                                                      | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                                           | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                            | 774.7-800.1             | 785.0              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 455.1              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.6              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 83.0               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 125.6              |
| G                                                                           | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 243.9-259.1             | 245.9              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 45.0               |
| I                                                                           | SHOULDER TO ELBOW LENGTH       | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2             | 296.1              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 192.3              |
| K                                                                           | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 520.7-546.1             | 540.2              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 365.6              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 395.8              |
| N                                                                           | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 414.0-439.4             | 434.5              |

| HYBRID III 5 <sup>th</sup> SN #124, PART 572, SUBPART O EXTERNAL DIMENSIONS, continued |                                                           |                                                         |                         |                    |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                              | DESCRIPTION                                               | DETAILS                                                 | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O                                                                                      | CHEST DEPTH WITHOUT JACKET                                | Measured 304.8 ± 5.1 mm above seat surface              | 175.3-190.5             | 176.0              |
| P                                                                                      | FOOT LENGTH                                               | Tip of toe to rear of heel                              | 218.5-233.7             | 219.4              |
| Q                                                                                      | STANDING HEIGHT                                           | (THEORETICAL)                                           | 1501.1                  | N/A                |
| R                                                                                      | BUTTOCK TO KNEE PIVOT LENGTH                              | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6             | 481.0              |
| S                                                                                      | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 138.6              |
| T                                                                                      | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 186.2              |
| U                                                                                      | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 310.7              |
| V                                                                                      | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 354.9              |
| W                                                                                      | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 82.0               |
| X                                                                                      | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 547.1              |
| Y                                                                                      | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 881.0              |
| Z                                                                                      | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 786.3              |
| AA                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 357.4              |
| BB                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 169.8              |

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- ☒ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- ☒ 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 294 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 1.6 g  |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Jessica Hall  
Signature

09/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test ID:** D143071

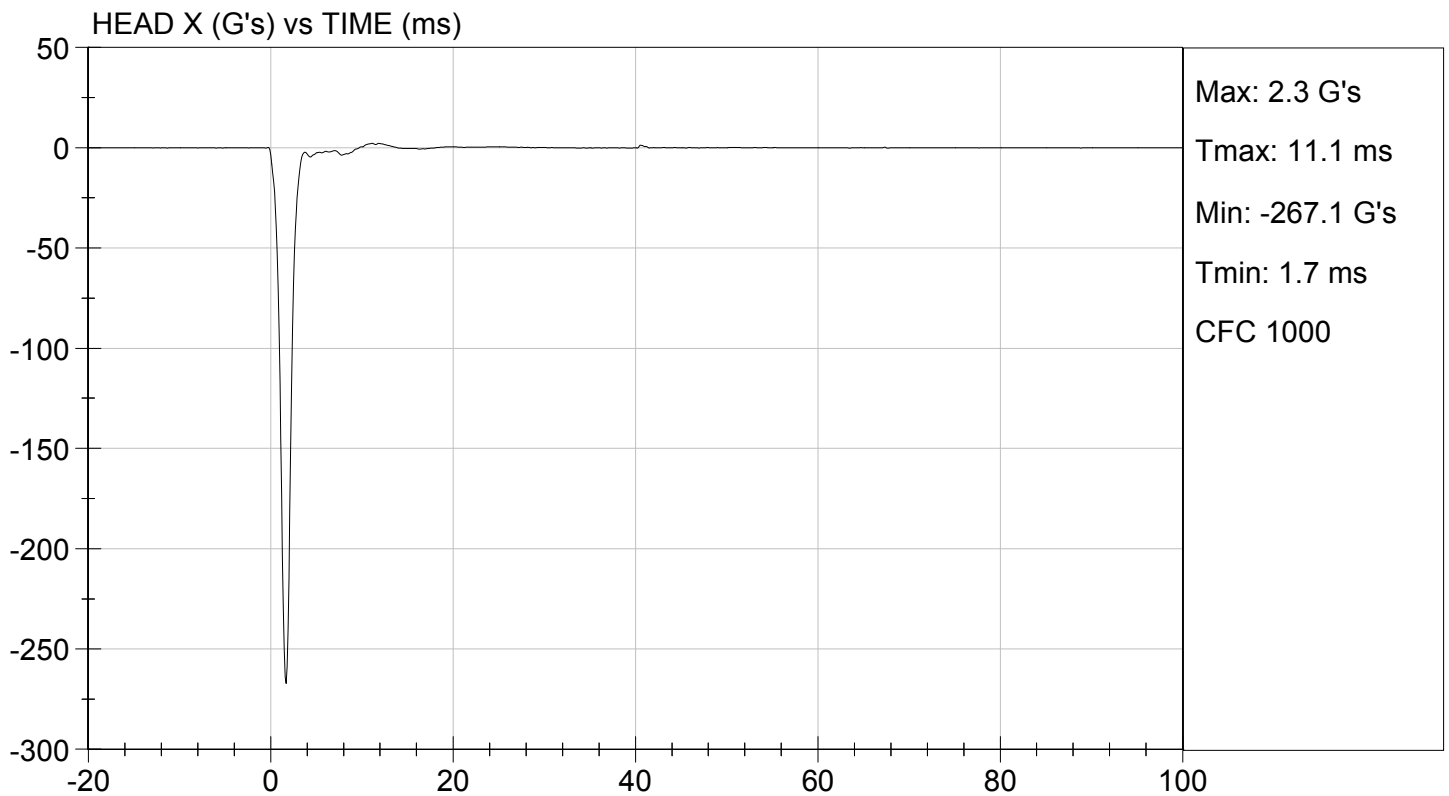
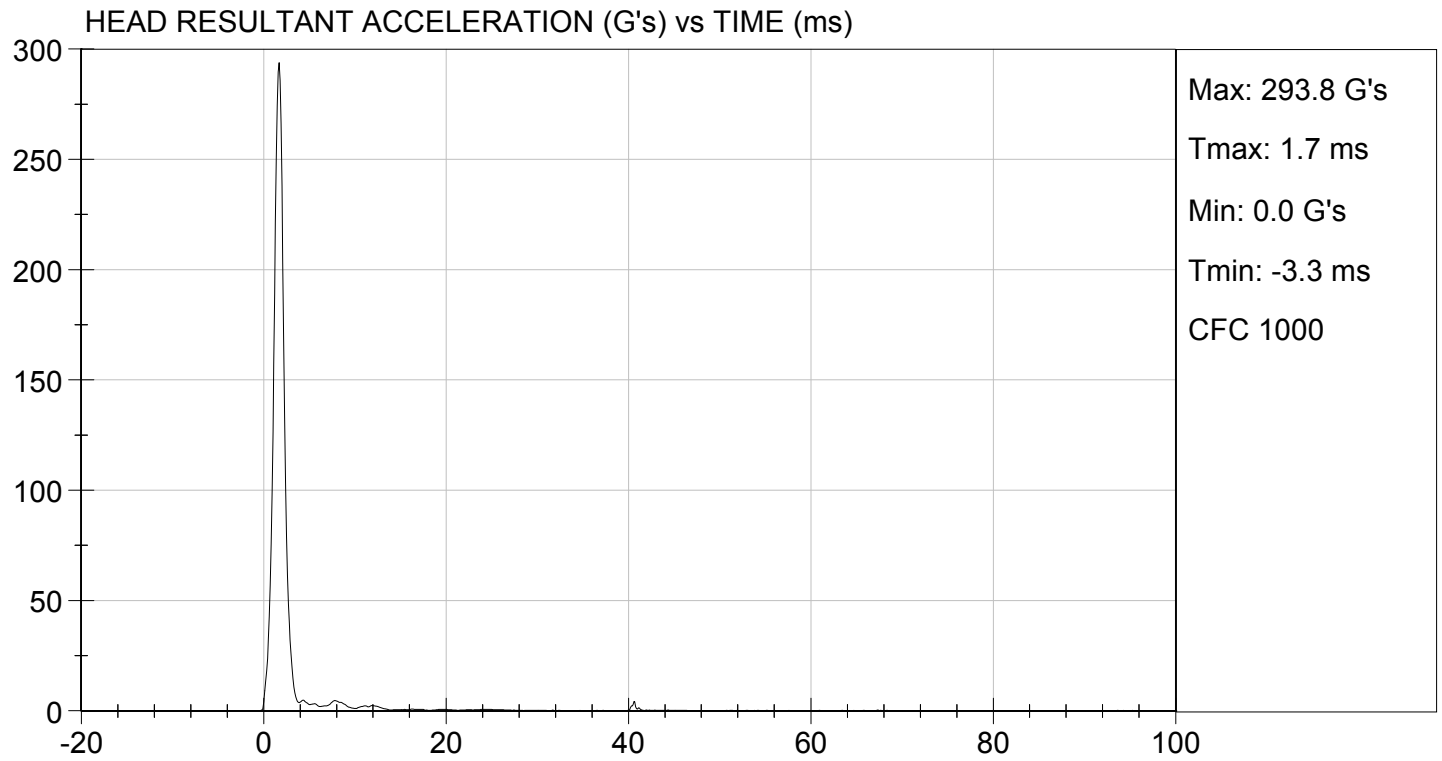
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.7   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 51     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 294    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 1.6    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

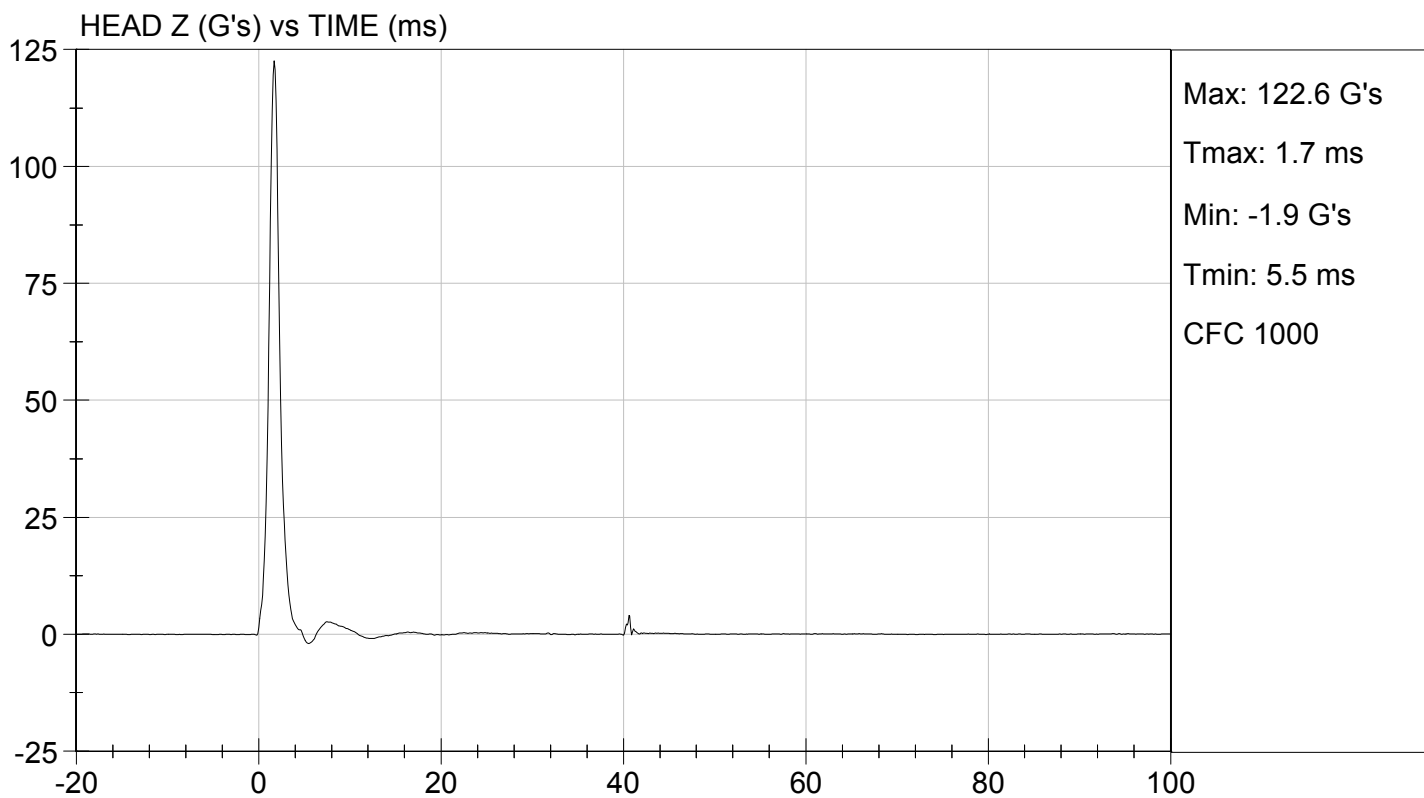
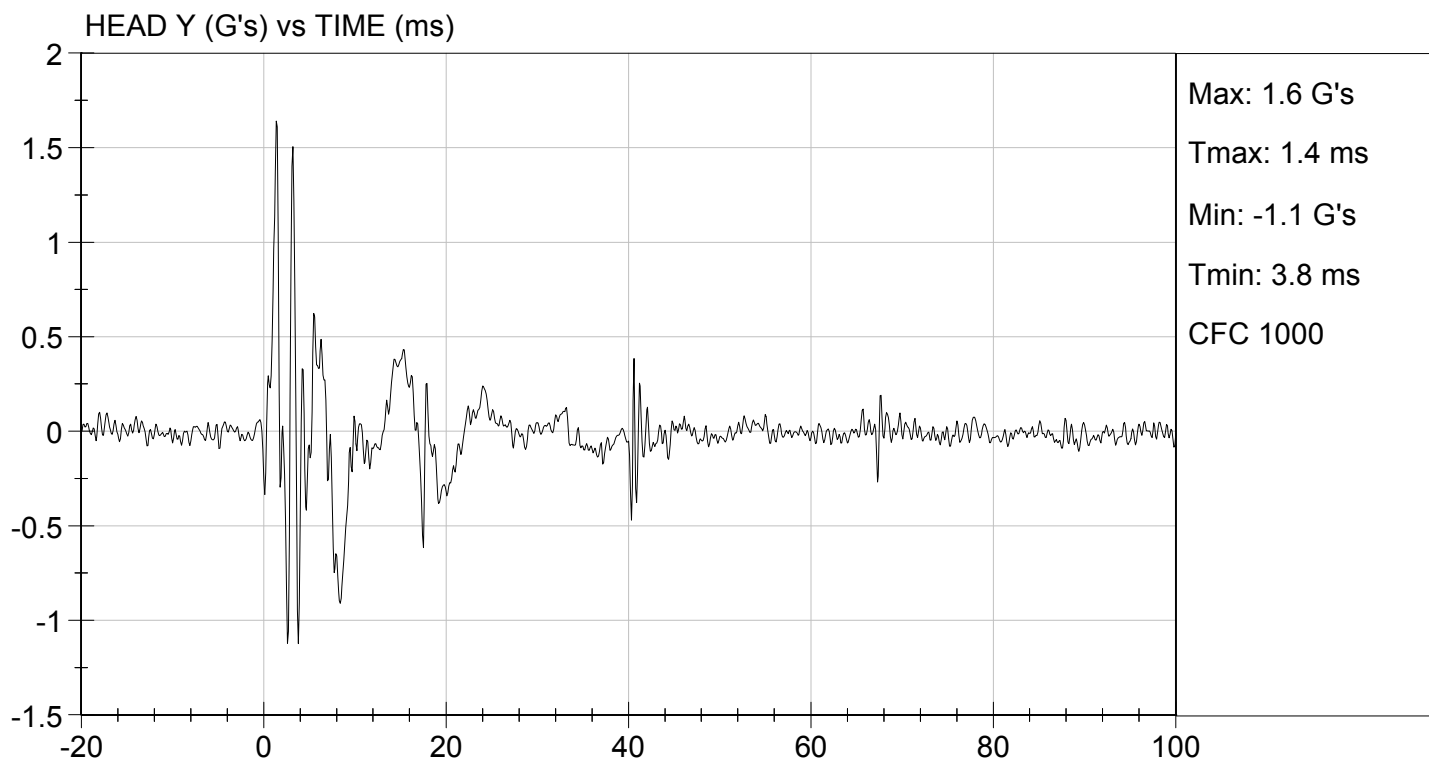
Jessica Hall  
Laboratory Technician

09/09/2014

Test Date

Jeff Leonard  
Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- X 1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                       | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 6.89 m/s $\leq$ speed $\leq$ 7.13 m/s                                                                               | 6.96 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                                | 2.3 m/s            |
|                                                  | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                                | 4.6 m/s            |
|                                                  | @ 30 ms | 5.8 m/s $\leq \Delta V \leq$ 7.0 m/s                                                                                | 6.4 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range<br>77° $\leq$ angle $\leq$ 91° | 70 Nm @ 82 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>80 ms $\leq$ time $\leq$ 100 ms                                                           | 88 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

Jessica Hall  
Signature

09/09/2014  
Date

## MGA RESEARCH CORPORATION

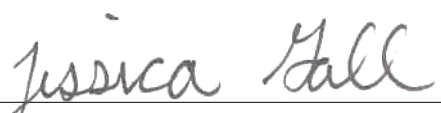
## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

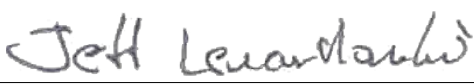
ATD Serial No: 124

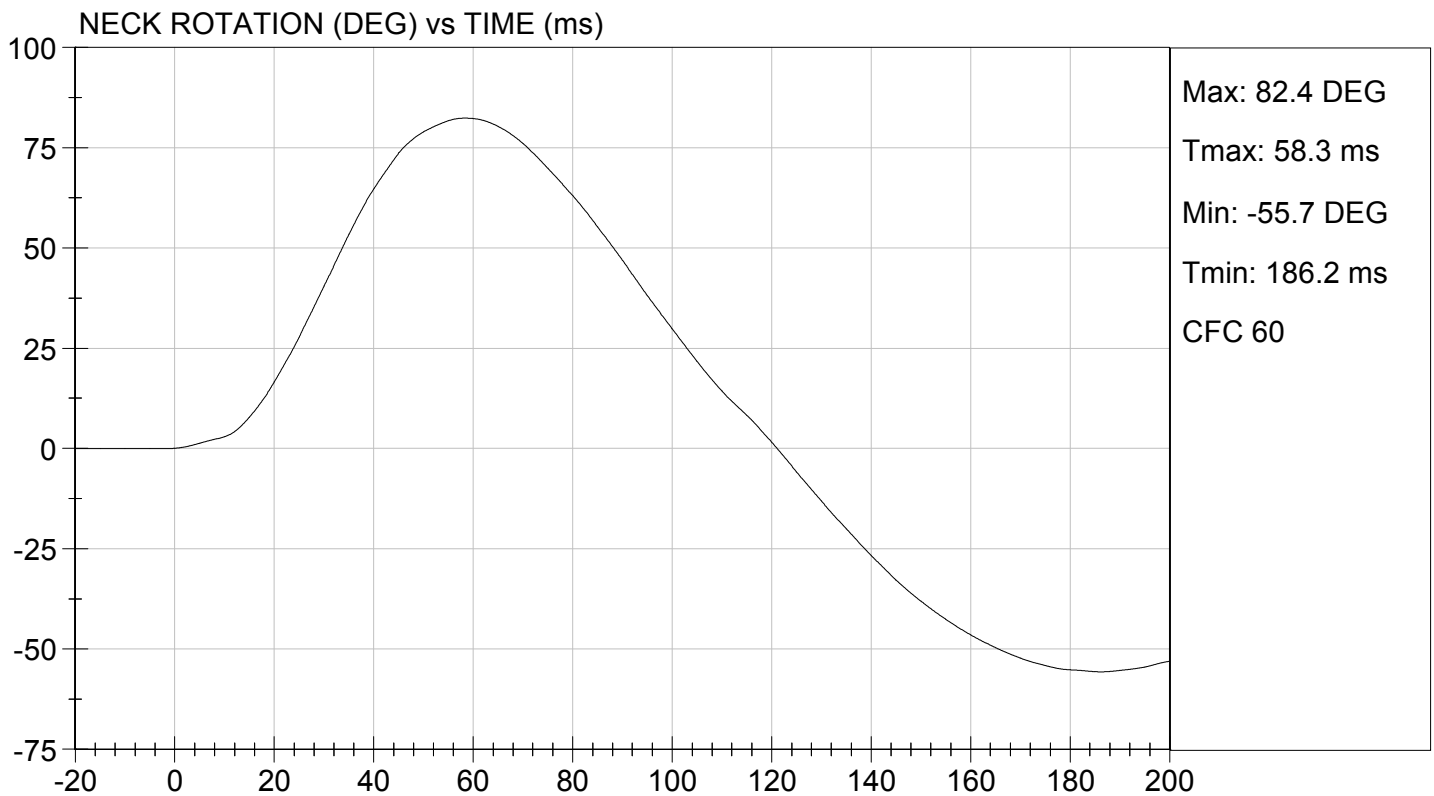
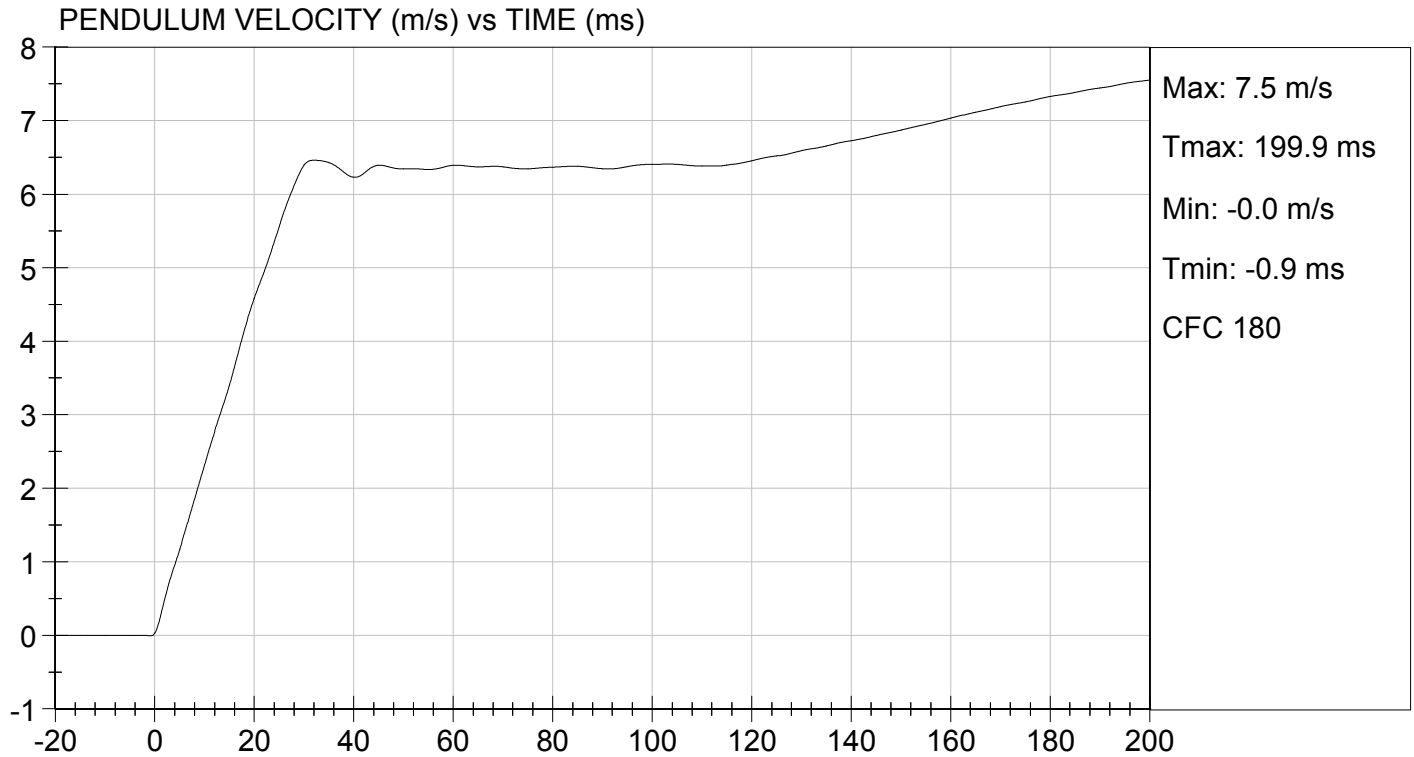
Test I.D: D143072

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.5   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 49     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 6.96   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.3    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.6    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 6.4    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 82     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 70     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 88     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

  
 Laboratory Technician

09/09/2014  
 Test Date

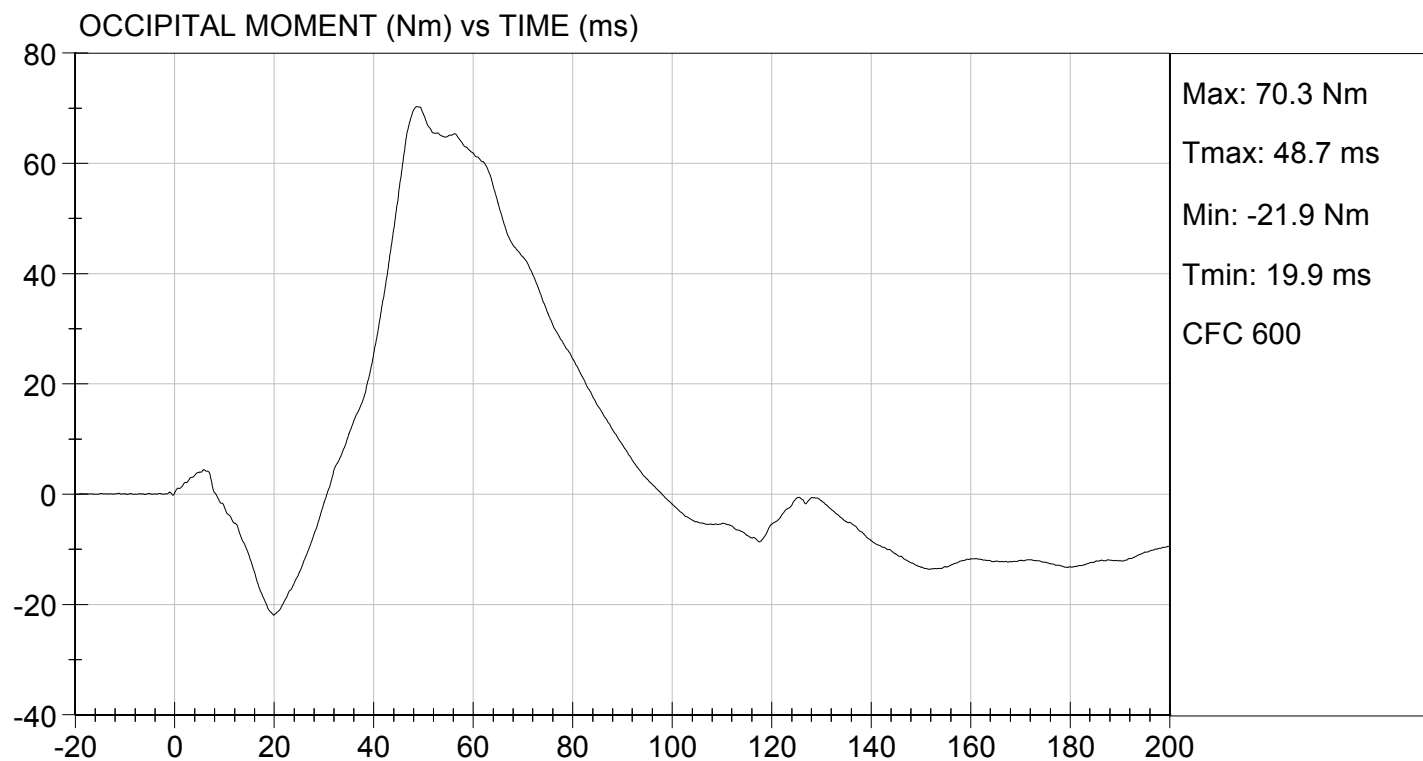
  
 Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 09/09/2014  
TEST #: D143072



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last extension test. (572.137(q))  
X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.12 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.7 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.4 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.0 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -56 Nm @ 104 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 102 ms               |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

  
Signature

09/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

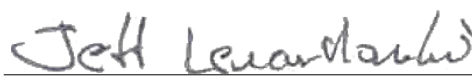
**ATD Serial No:** 124

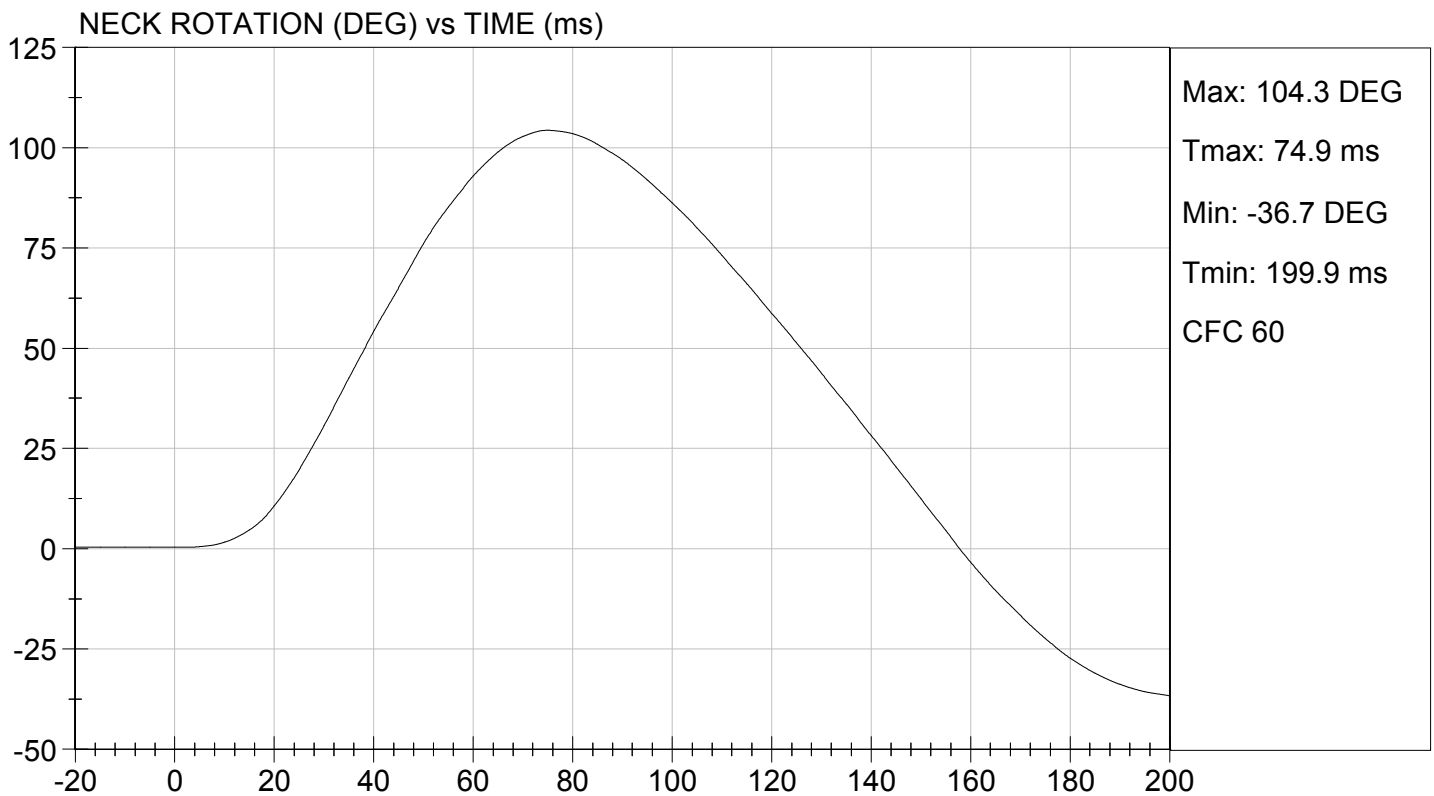
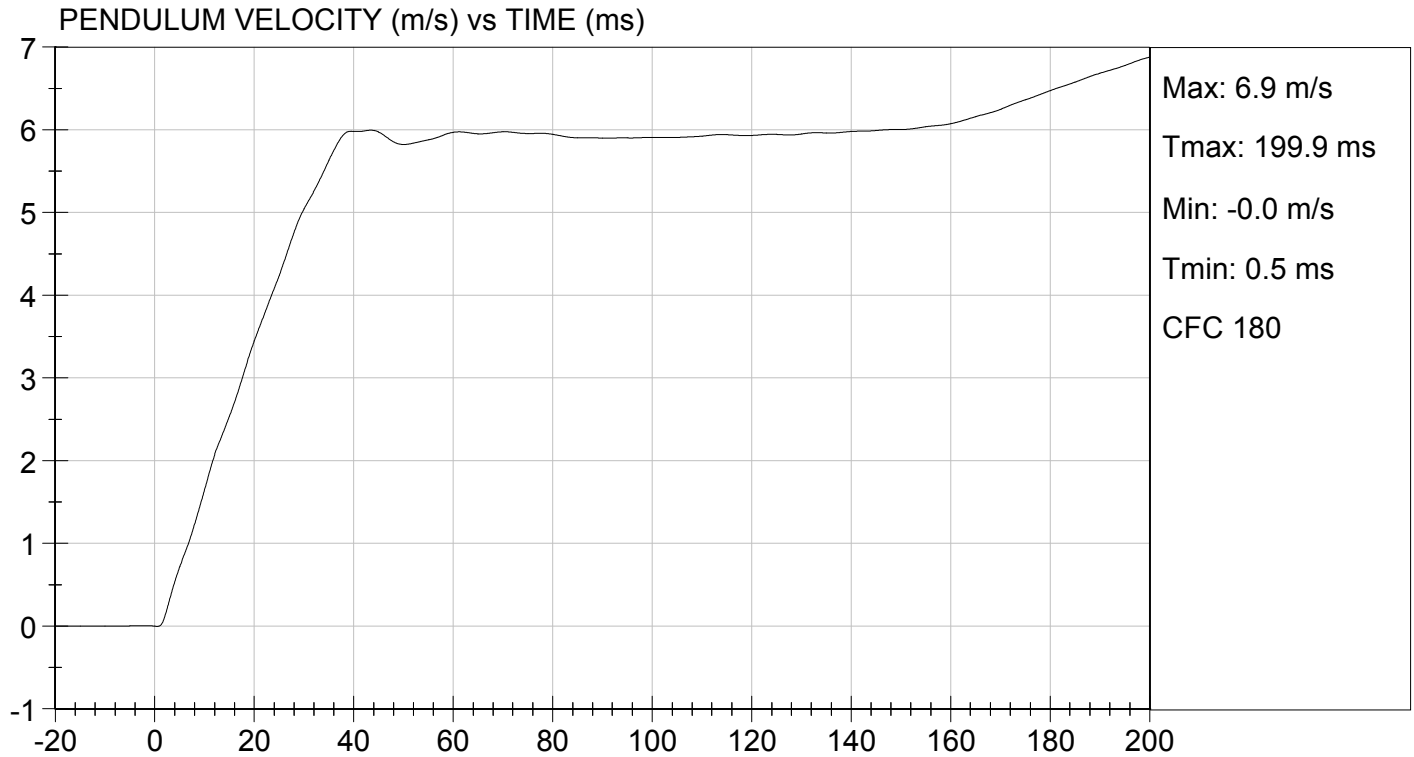
**Test I.D:** D143073

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.12   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.7    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.4    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.0    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 104    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -56    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 102    | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

  
 Laboratory Technician

09/09/2014  
 Test Date

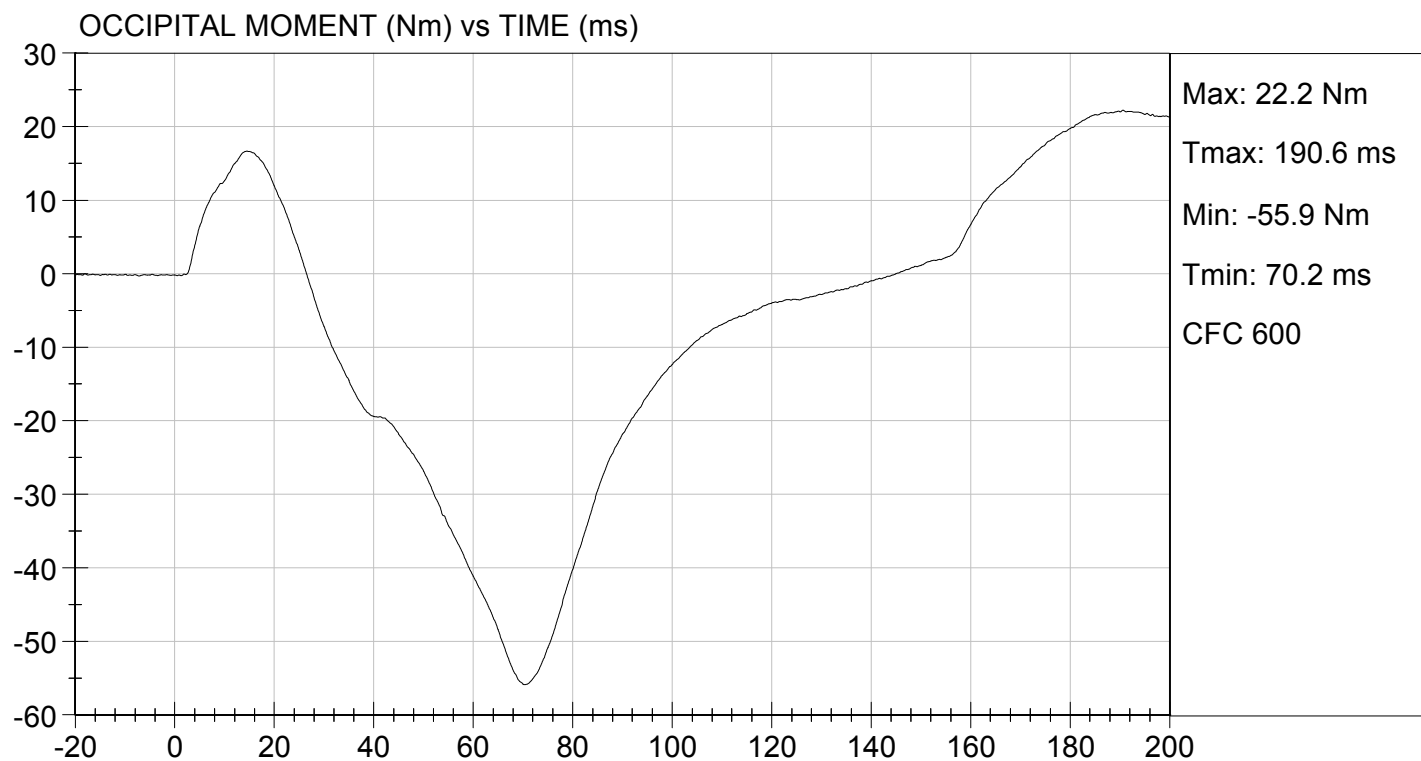
  
 Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 09/09/2014  
TEST #: D143073



**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- ☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- ☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No Damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

☐ - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

- X   16. Complete the following table:  
Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.60 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 51 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4300 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq 4600 \text{ N}$                               | 4226 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

- X   17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

                    Jessica Hall                      
Signature

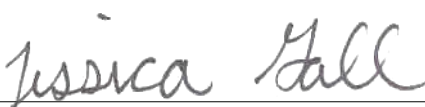
                    09/09/2014                      
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

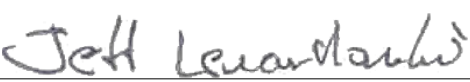
**Test I.D:** D143074

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 51     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.60   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 55     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4300   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4226   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

09/09/2014

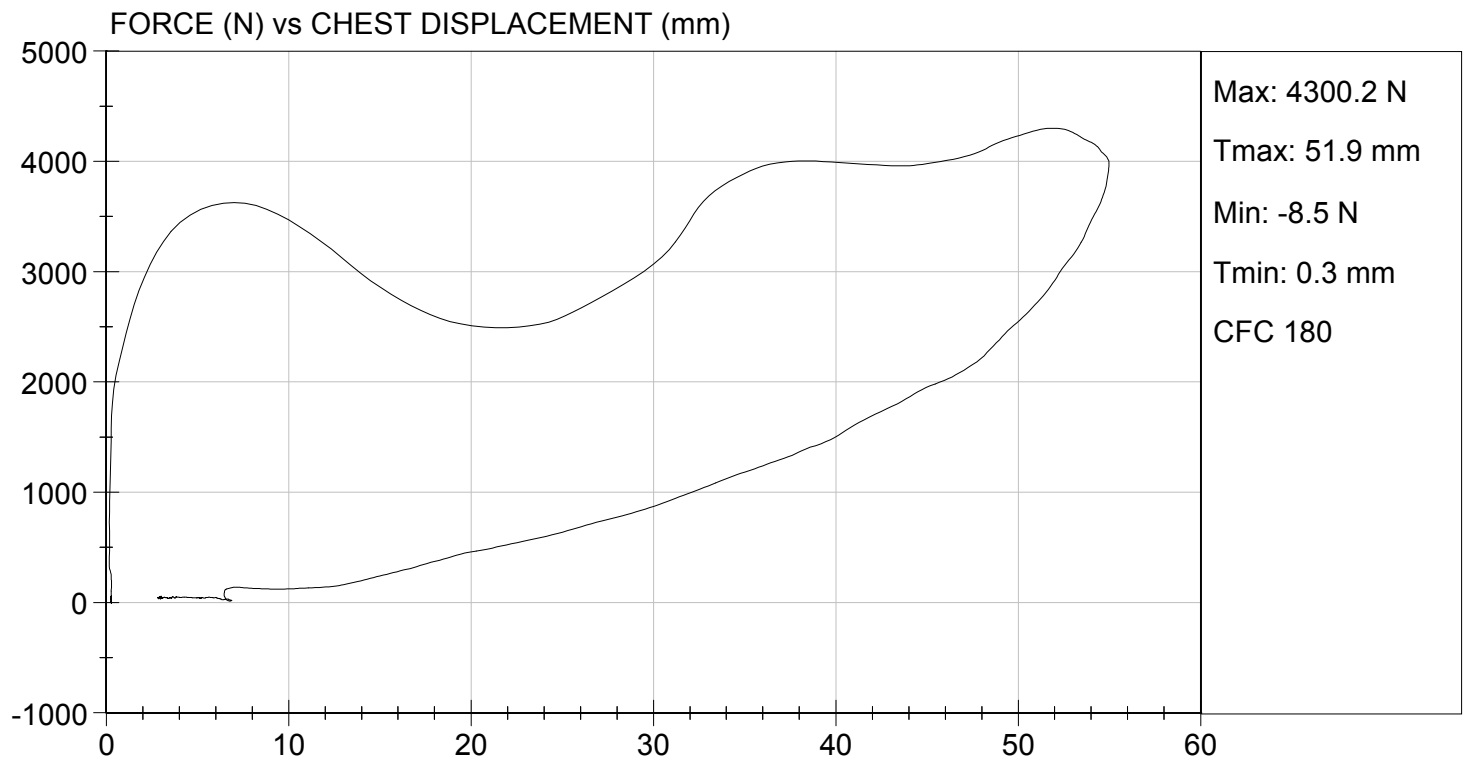
Test Date

  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 09/09/2014  
TEST #: D143074



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
☒ N/A, ONLY one torso flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
☐ With legs below femurs.  
☒ Without legs below femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- ☒ 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- ☒ 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):           See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 20 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.9 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 384 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 21 deg      |

          Jessica Hall            
 Signature

          09/09/2014            
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143077

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.7   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 51     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 20     | Pass      |
| Return Angle                 | deg   | +/- 8         | 21     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 384    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.9    | Pass      |
| Overall Result               |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

09/09/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

- |   |     |                                                                                                                                                                                                                                                                        |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X | 10. | Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.<br>(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.<br>(572.136(c)(6)) |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3530 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

- X 12. Plots of acceleration versus time and force versus time follow this sheet.

Jessica Gall  
Signature

09/09/2014

Date \_\_\_\_\_

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143076

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.5   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 49     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3530   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

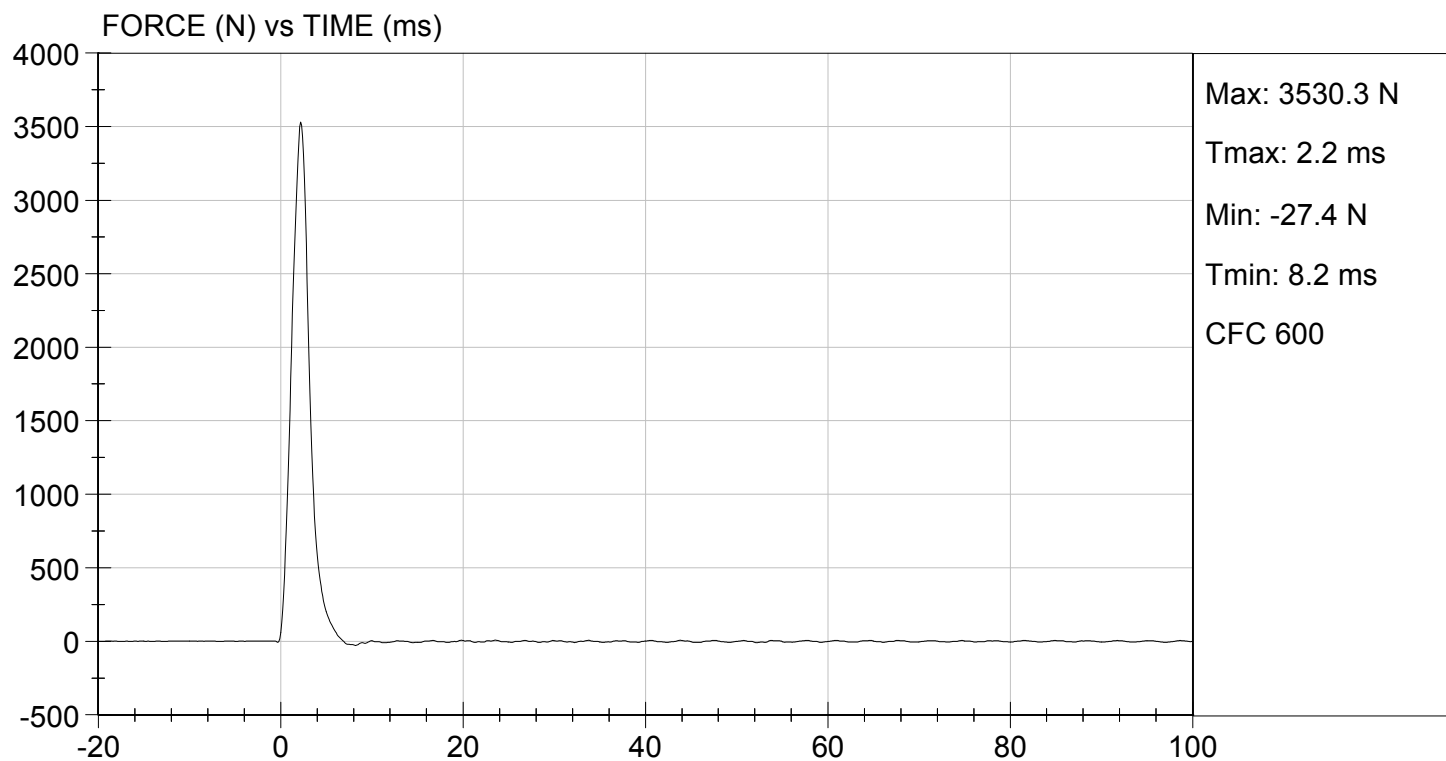
09/09/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 09/09/2014  
TEST #: D143076



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
☒ N/A, ONLY one knee impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 14B.
- ☒ 3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- ☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- ☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- ☒ 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- ☒ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- ☒ 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- ☒ 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.



**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143075

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.5   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 49     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.11   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3803   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Gall  
Laboratory Technician

09/09/2014

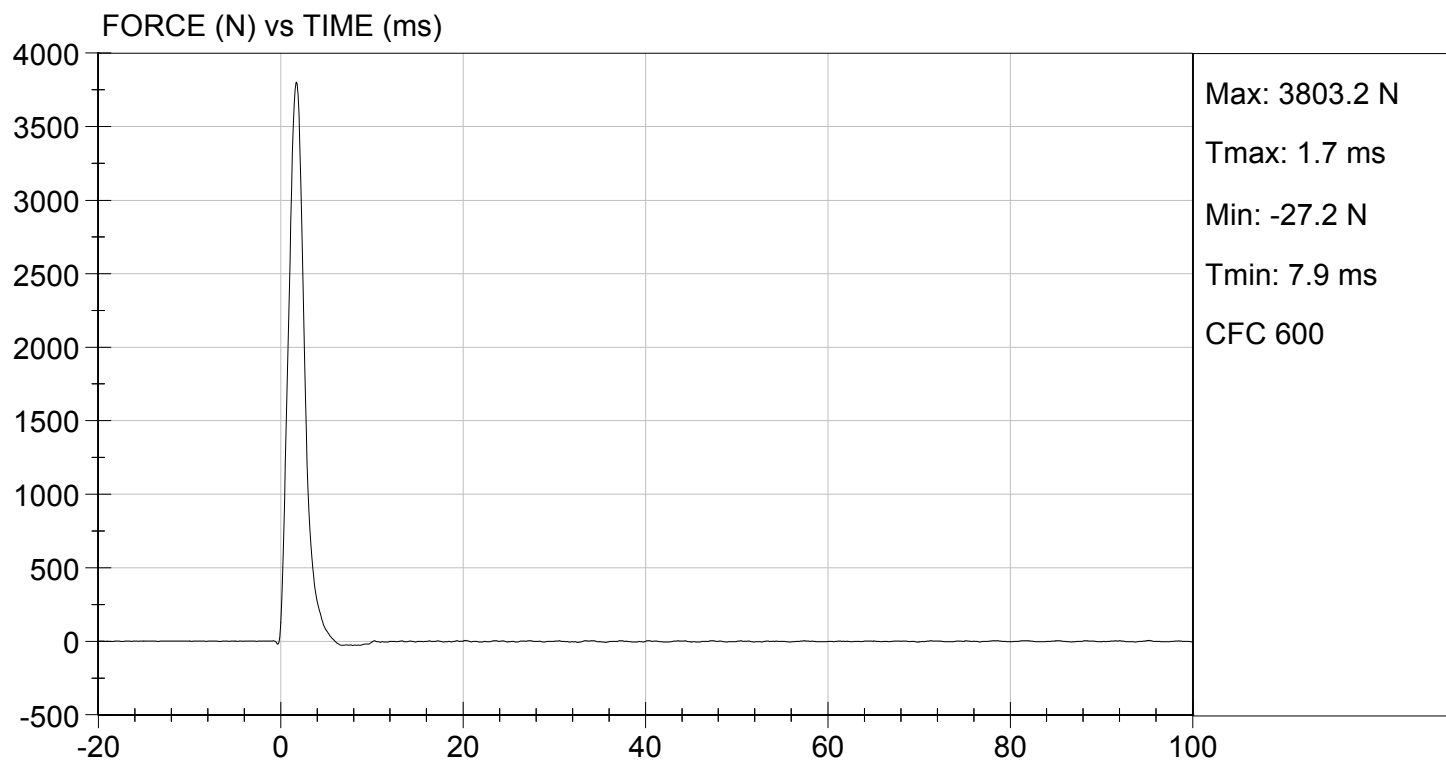
Test Date

Jeff Leonard  
Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 09/09/2014  
TEST #: D143075



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78702     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78777     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78781     | 07/02/2014               | 01/02/2015               |
| NECK TRANSDUCER                       | Denton       | 2320                | 2320       | 05/30/2014               | 11/30/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79695     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79696     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79740     | 07/02/2014               | 01/02/2015               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 124        | 07/08/2014               | 01/08/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 1361       | 04/23/2014               | 10/23/2014               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 1362       | 04/23/2014               | 10/23/2014               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2015               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/01/2014               |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X  1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- X  3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X  4. Accelerometers and their respective mounts are smooth and clean.
- X  5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- X  7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X  8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 40.9 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result  |
|-------------------------------------|--------------------------------------------------|---------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 279 g   |
| Resultant versus time history curve | Unimodal                                         | Yes     |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes     |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -14.3 g |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel  
Signature

9/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test ID:** D143391

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.4   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 47     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 279    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -14.3  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

*David Schoedel*

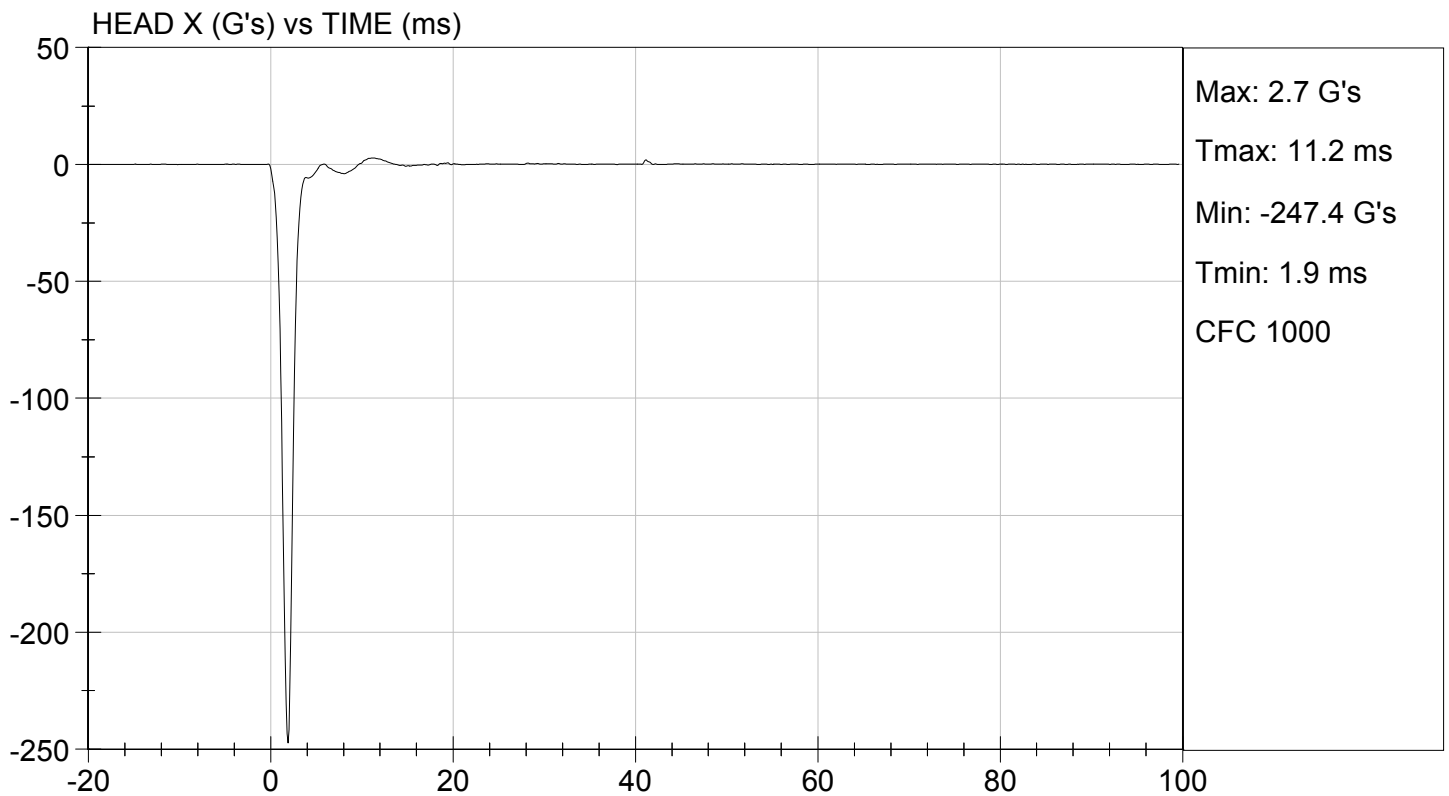
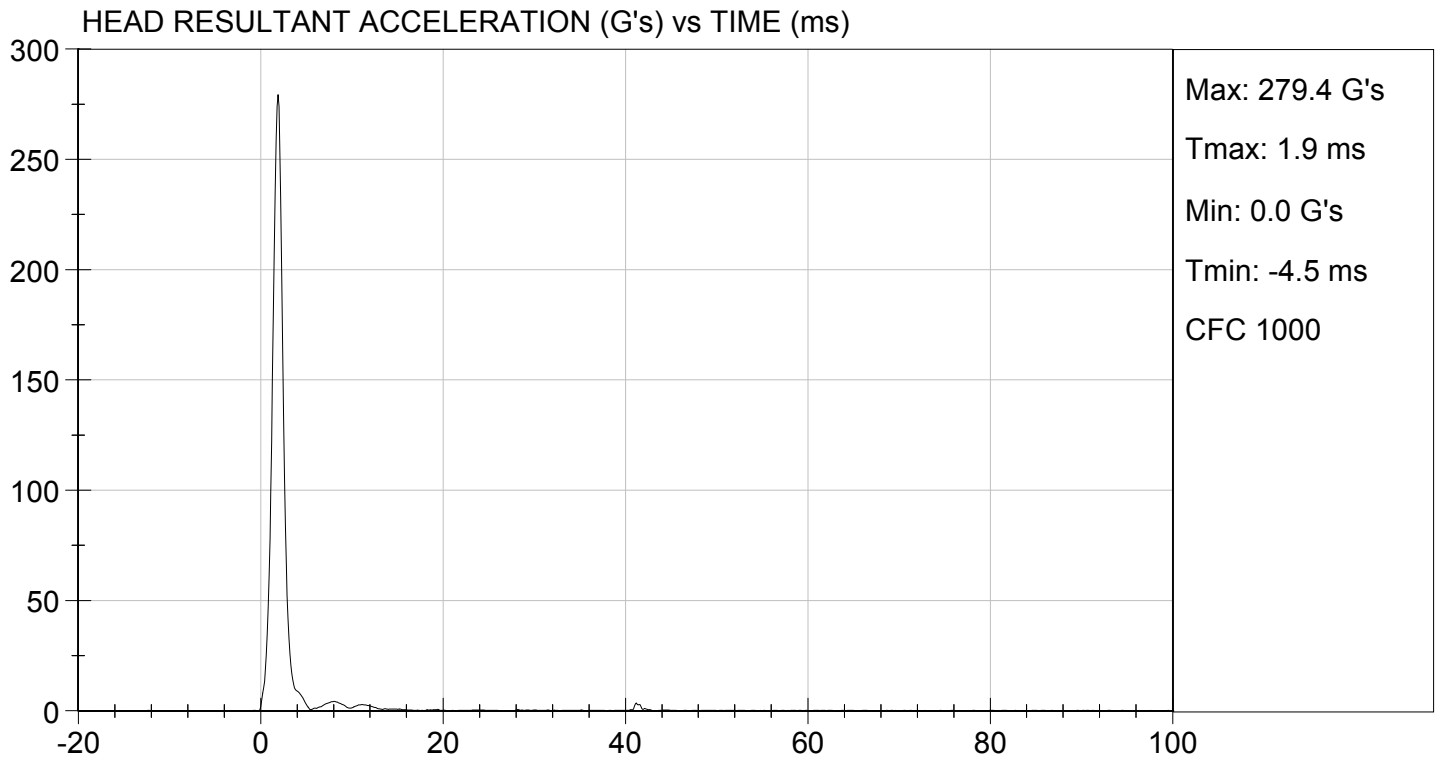
Laboratory Technician

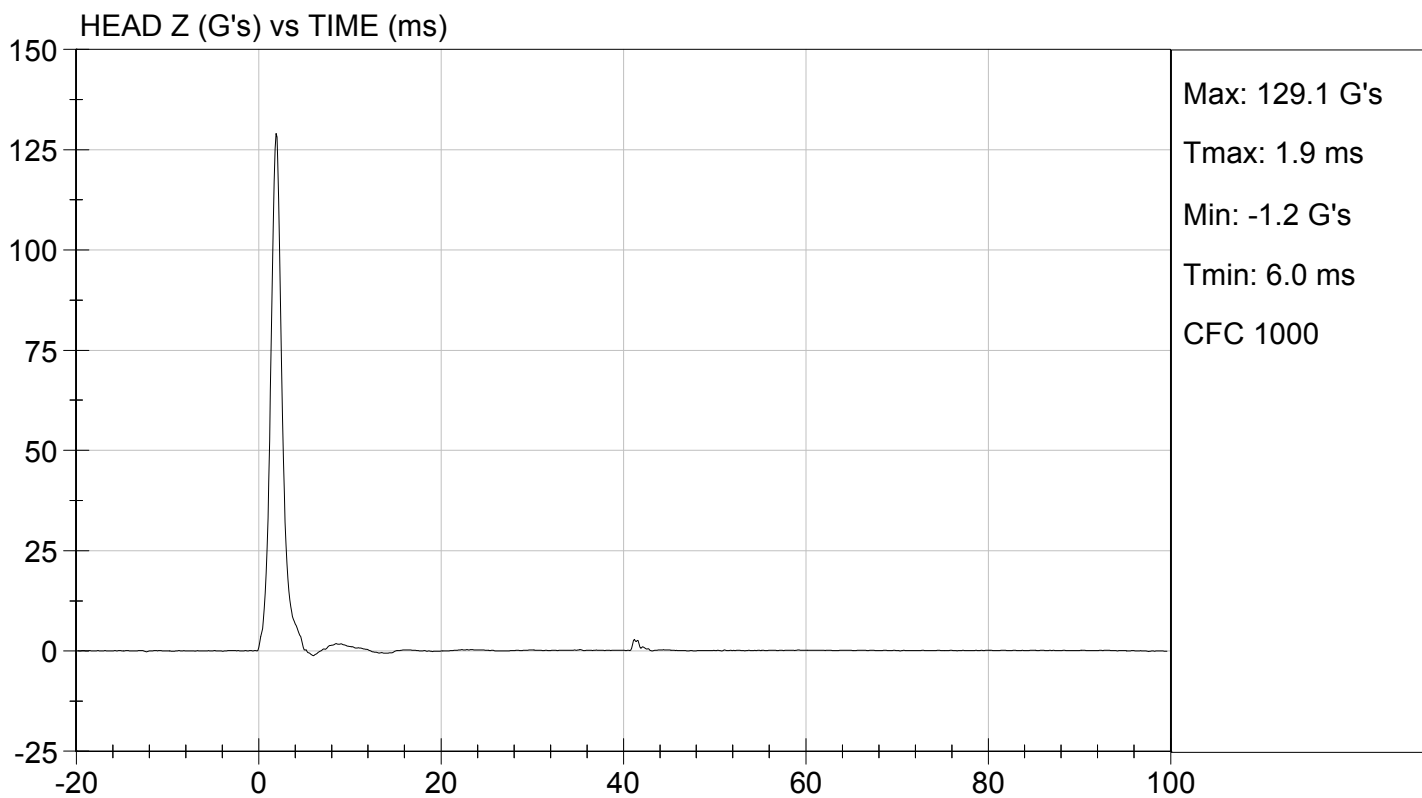
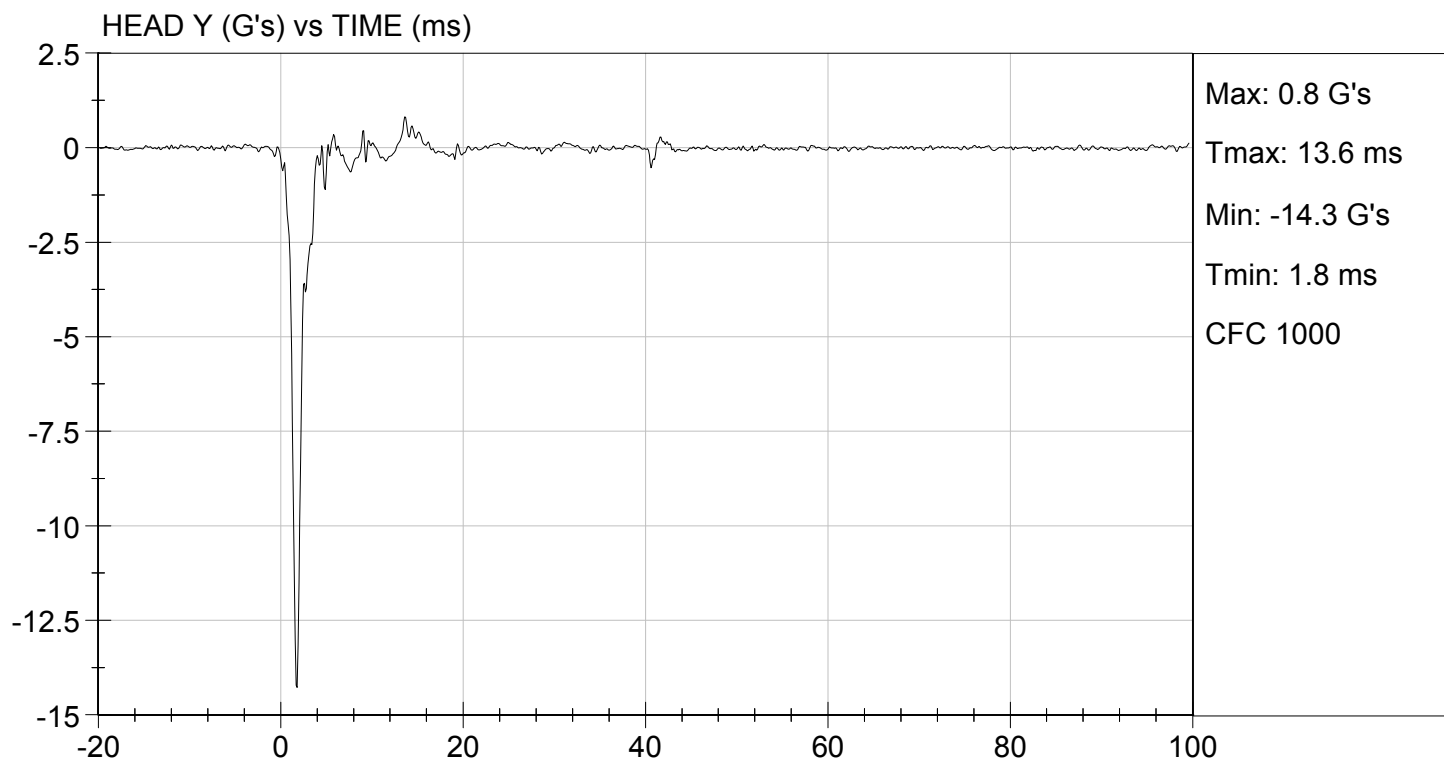
09/29/2014

Test Date

*Jeff Leonard*

Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: David Schoedel

       Pre test calibration  
  X   Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

  X   1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
         X   N/A, ONLY one neck test performed

  X   2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

  X   3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |

  X   4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

  X   5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

  X   6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                                                           | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | $6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$                                                                                              | 7.13 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$                                                                                                    | 2.3 m/s            |
|                                                  | @ 20 ms | $4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                    | 4.3 m/s            |
|                                                  | @ 30 ms | $5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$                                                                                                    | 5.9 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>$69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range<br>$77^\circ \leq \text{angle} \leq 91^\circ$ | 75 Nm @ 78 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>$80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$                                                                          | 89 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

David Schoedel  
Signature

9/29/2014  
Date

## MGA RESEARCH CORPORATION

## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 124

Test I.D: D143392

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 7.13   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.3    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.3    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 5.9    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 78     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 75     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 89     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |



Laboratory Technician

09/29/2014

Test Date

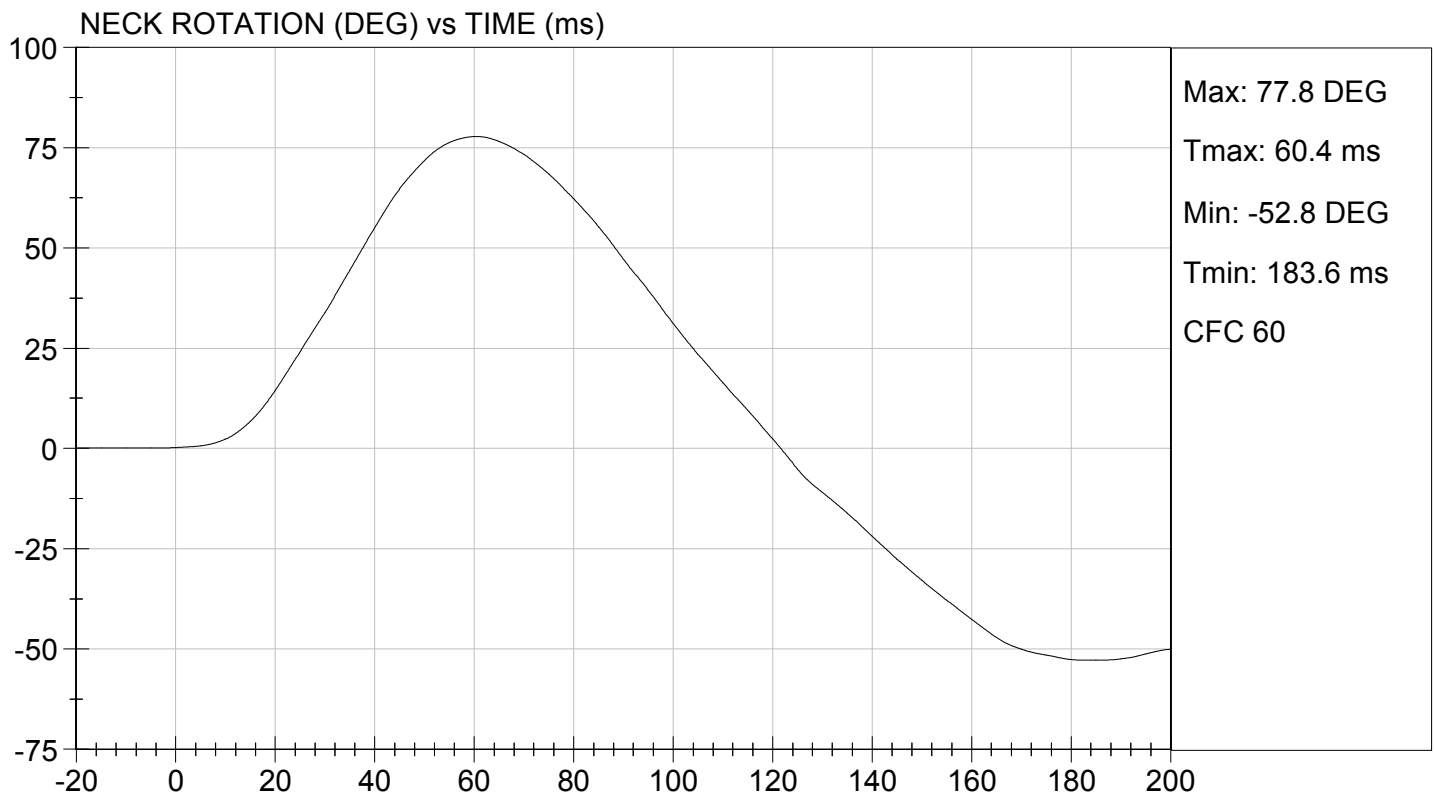
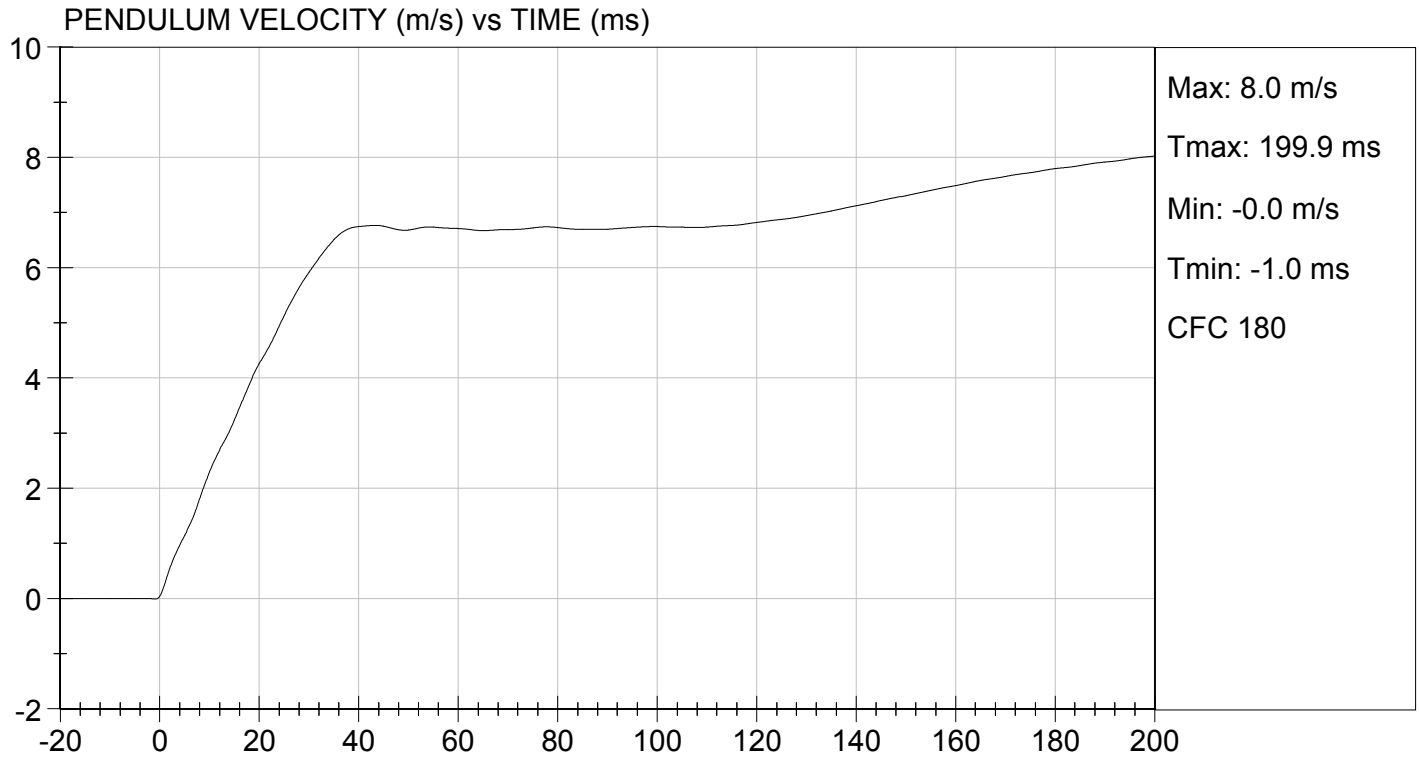


Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 23.40 ft/s, 7.13 m/s

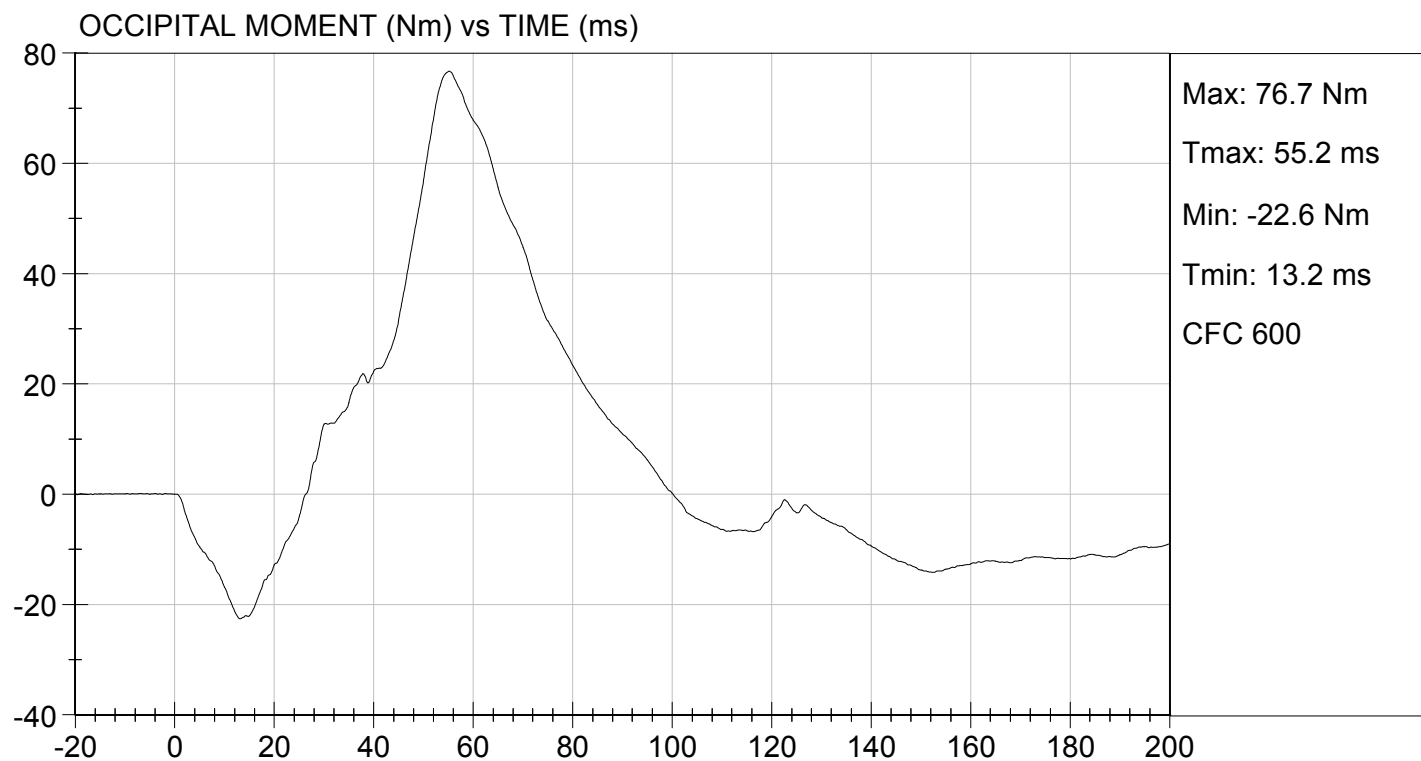
TEST DATE: 09/29/2014  
TEST #: D143392





TEST DESC: NECK FLEXION  
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 09/29/2014  
TEST #: D143392



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X  1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 X  N/A, ONLY one neck test performed
- X  2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X  3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X  4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X  5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X  6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.19 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.7 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.6 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.2 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -54 Nm @ 105 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 98 ms                |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

9/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

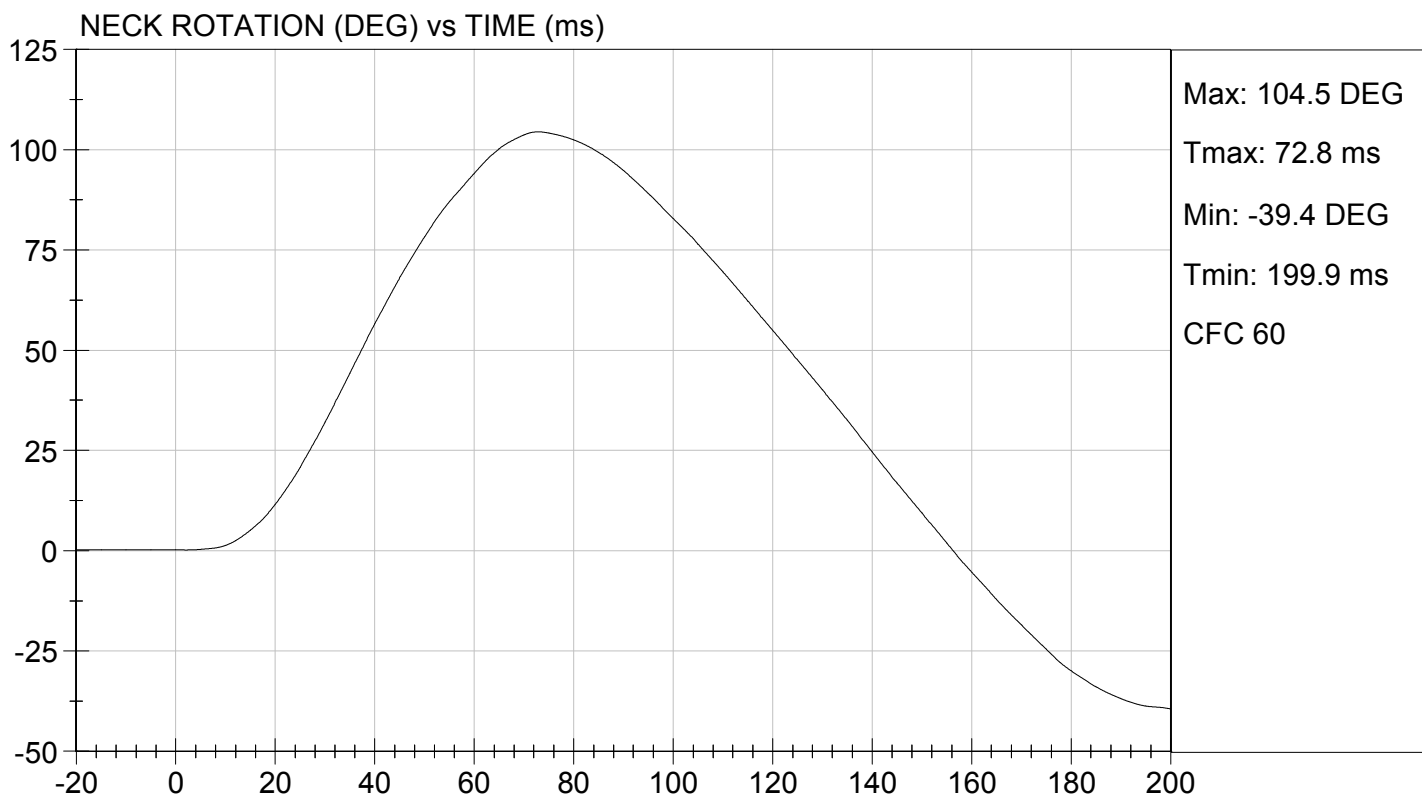
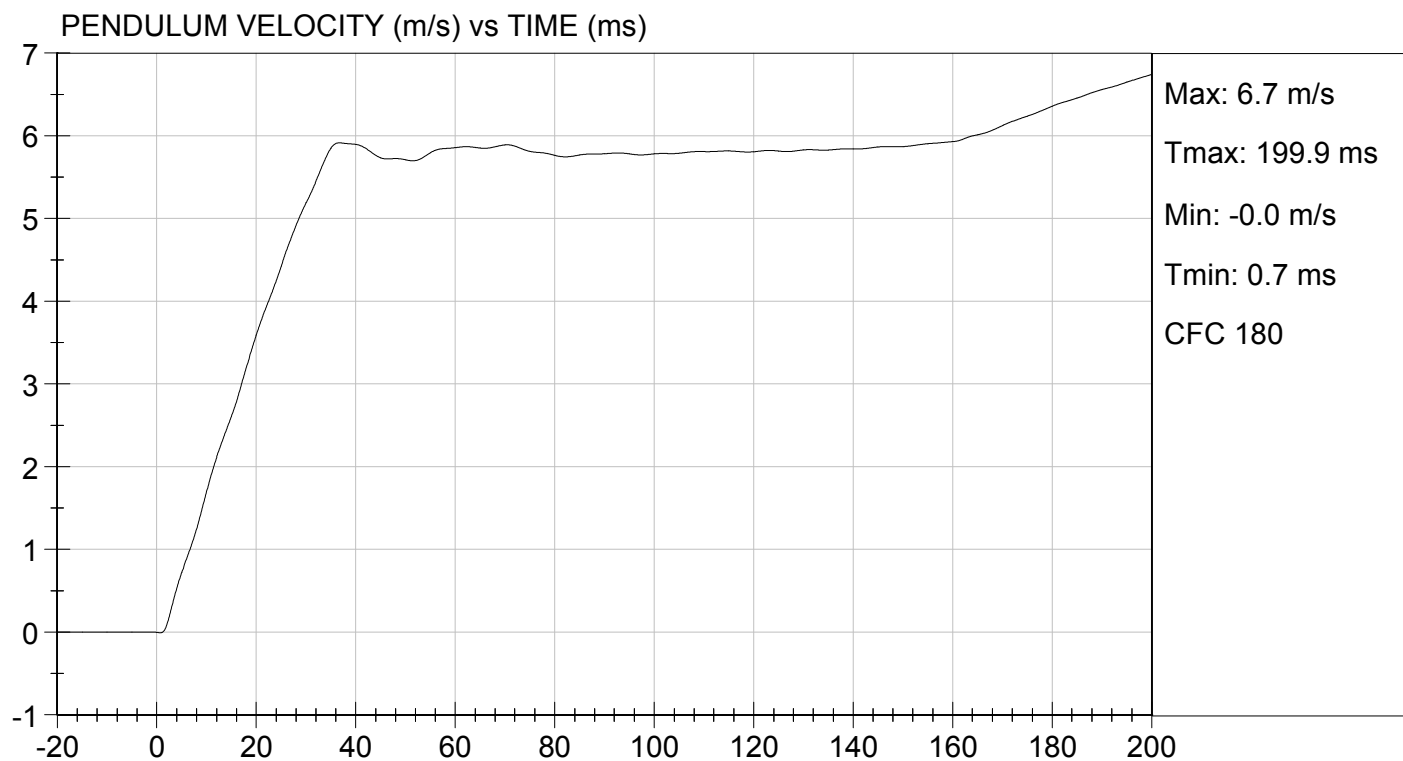
**Test I.D:** D143393

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.19   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.7    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.6    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.2    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 105    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -54    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 98     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

09/29/2014  
Test Date

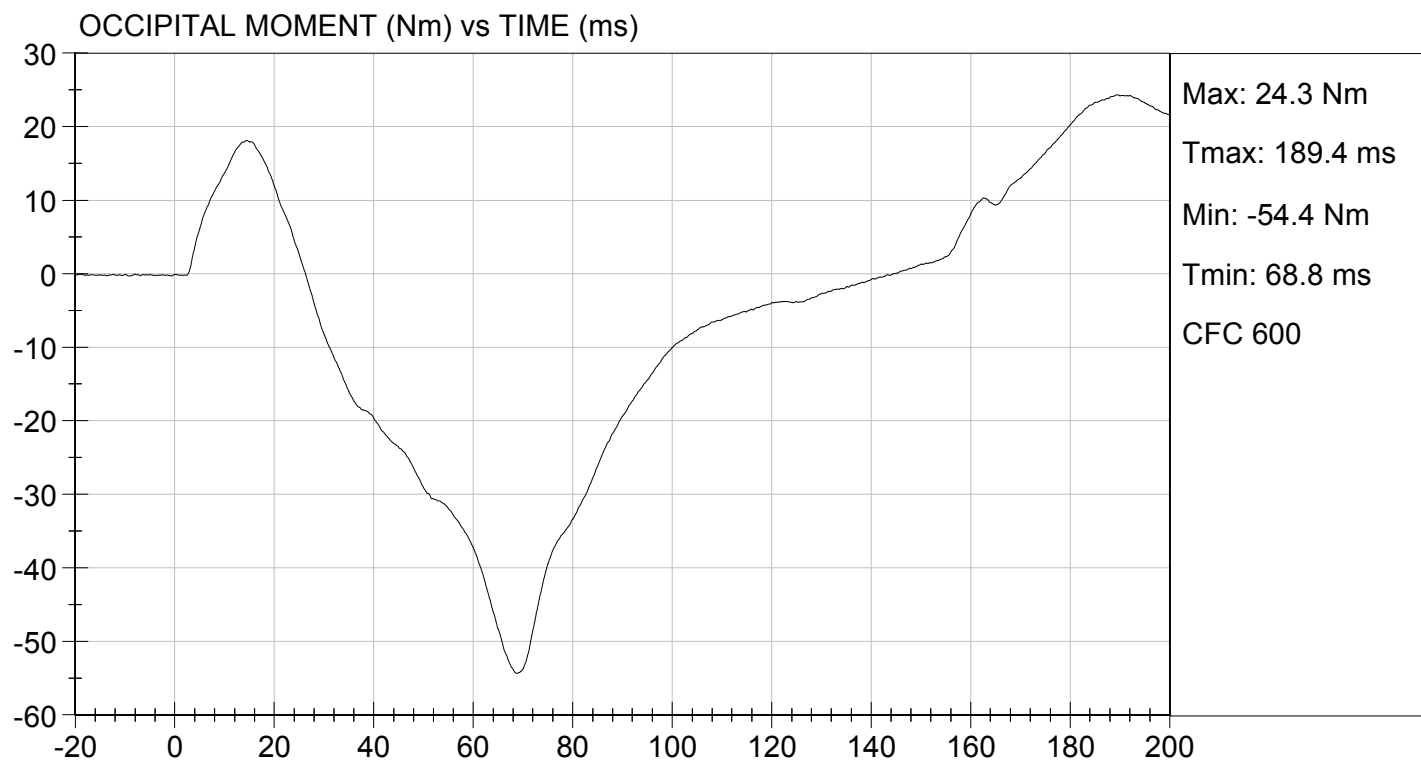
Jeff Leonard  
Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 09/29/2014  
TEST #: D143393



**DATA SHEET B6**  
**THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: Jack Coleman

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X  1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
      X  N/A, ONLY one thorax impact test performed
- X  2. The test fixture conforms to the specifications in Figure 11B.
- X  3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- X  4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |

- X  5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X  - No Damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

     - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X   16. Complete the following table:

Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.77 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 55 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4337 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq 4600 \text{ N}$                               | 4279 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

  X   17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Jack Coleman  
Signature

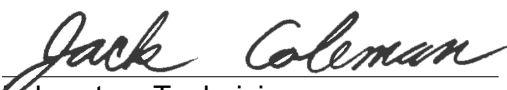
9/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

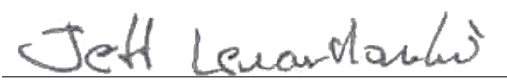
**Test I.D:** D143394

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.0   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.77   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 55     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4337   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4279   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

09/29/2014

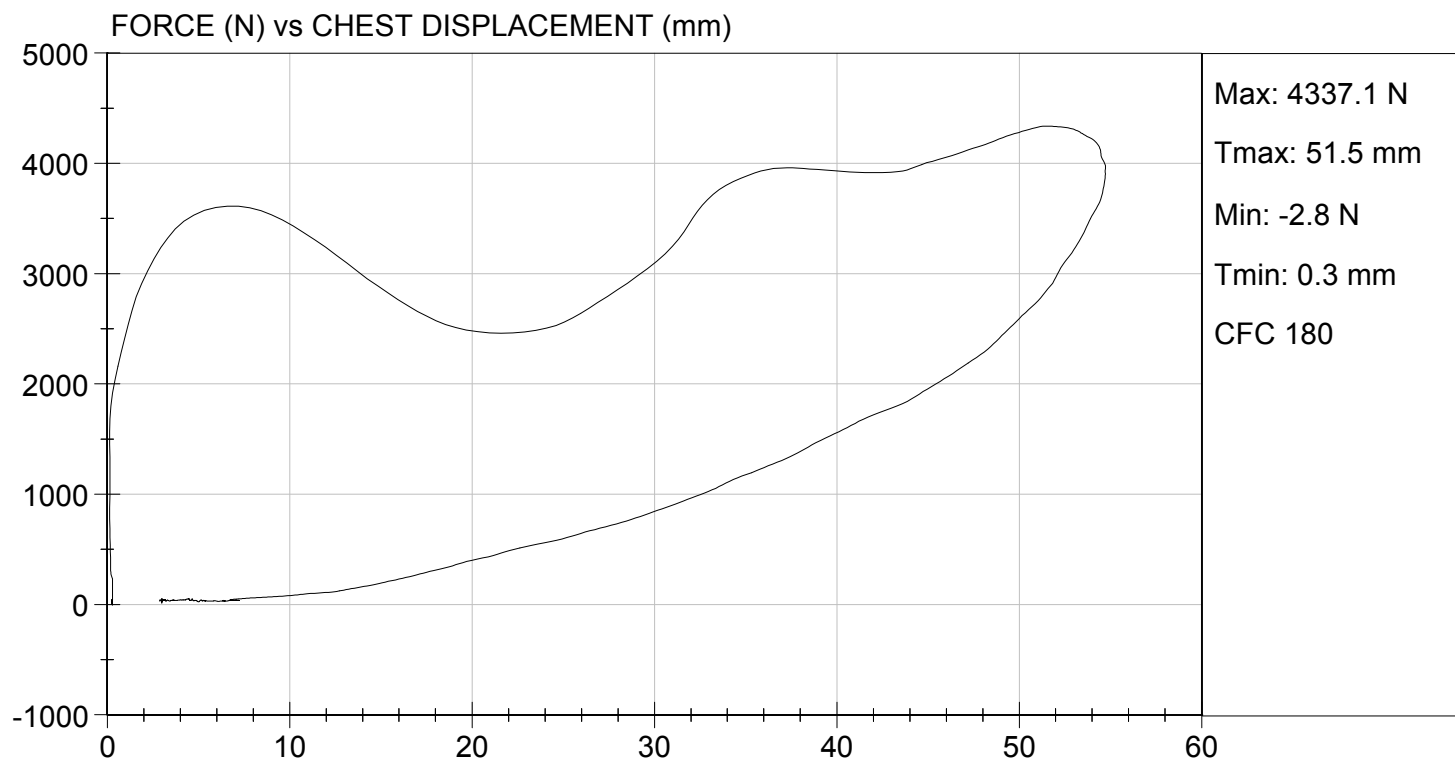
Test Date

  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/29/2014  
TEST #: D143394



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X  1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
      X  N/A, ONLY one torso flexion test performed
- X  2. The test fixture conforms to the specifications in Figure 13B.
- X  3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
          With legs below femurs.  
      X  Without legs below femurs.
- X  4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X  5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X  6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X  7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X  8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):           See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 17 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.9 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 365 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 20 deg      |

Maxime Chamberland  
 Signature

9/29/2014  
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143397

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.4   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 17     | Pass      |
| Return Angle                 | deg   | +/- 8         | 20     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 365    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.9    | Pass      |
| Overall Result               |       |               |        | Pass      |

Maxime Chamberland  
Laboratory Technician

09/29/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X  1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 X  N/A, ONLY one knee impact test performed
- X  2. The test fixture conforms to the specifications in Figure 14B.
- X  3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X  4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X  5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X  6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X  7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X  8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X  9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3563 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Maxime Chamberland  
Signature

9/29/2014  
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143396

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 20.8   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3563   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Maxime Chamberland

Laboratory Technician

09/29/2014

Test Date

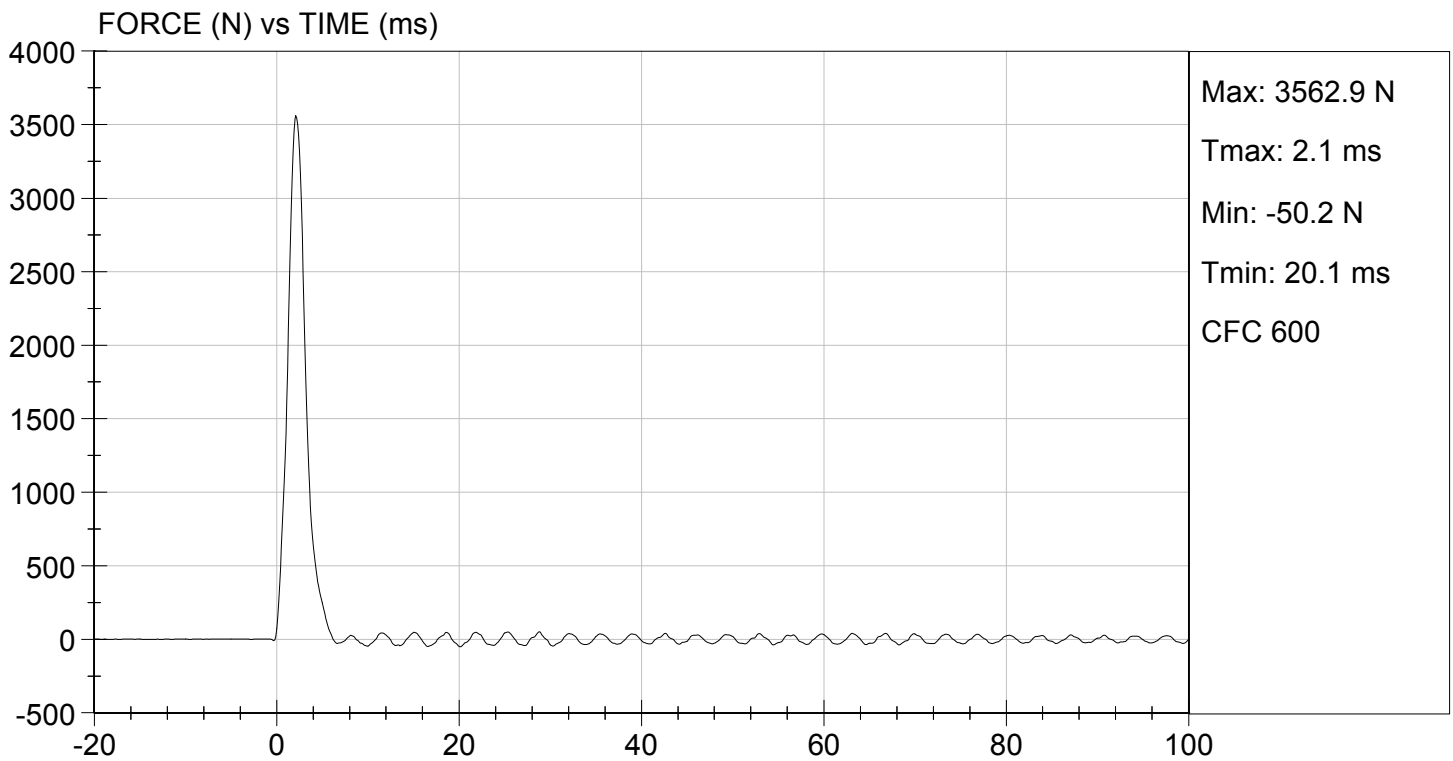
Jeff Leonard

Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 09/29/2014  
TEST #: D143396



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 9/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>20.8°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.10 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3611 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Maxime Chamberland  
Signature

9/29/2014  
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143395

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 20.9   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 45     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.10   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3611   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Maxime Chamberland

Laboratory Technician

09/29/2014

Test Date

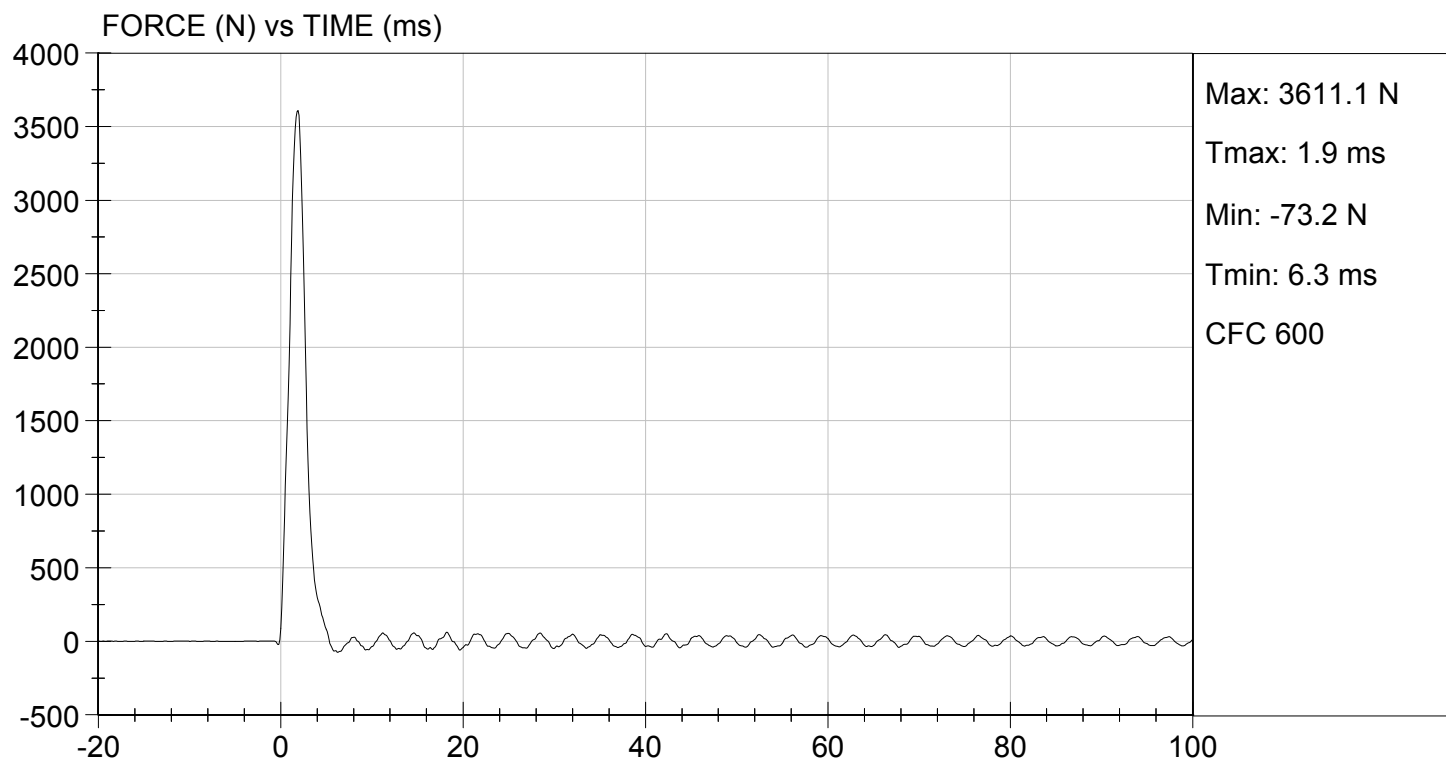
Jeff Leonard

Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 09/29/2014  
TEST #: D143395



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78702     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78777     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78781     | 07/02/2014               | 01/02/2015               |
| NECK TRANSDUCER                       | Denton       | 2320                | 1021       | 08/07/2014               | 02/07/2015               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79695     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79696     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79740     | 07/02/2014               | 01/02/2015               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 124        | 07/08/2014               | 01/08/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 1361       | 04/23/2014               | 10/23/2014               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 1362       | 04/23/2014               | 10/23/2014               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2015               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/01/2014               |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 124

Test Date: 09/28/2014

Technician: Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damage | OK |
|-----------------------------|--------------------------------------------------------------|----------|--------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |        | X  |
| Head                        | Ballast secure                                               |          |        | X  |
|                             | General appearance                                           |          |        | X  |
| Neck                        | Broken or cracked rubber                                     |          |        | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |        | X  |
|                             | Looseness at the condyle joint                               |          |        | X  |
|                             | Nodding blocks cracked or out of position                    |          |        | X  |
| Spine                       | Broken or cracks in rubber                                   |          |        | X  |
| Ribs                        | Broken or bent ribs                                          |          |        | X  |
|                             | Broken or bent rib supports                                  |          |        | X  |
|                             | Damping material separated or cracked                        |          |        | X  |
|                             | Rubber bumpers in place                                      |          |        | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |        | X  |
|                             | Slider arm riding in track                                   |          |        | X  |
| Transducer leads            | Torn cables                                                  |          |        | X  |
| Accelerometer Mountings     | Head mounting secure                                         |          |        | X  |
|                             | Chest mounting secure                                        |          |        | X  |
| Knees                       | Skin condition                                               |          |        | X  |
|                             | Insert (do not remove)                                       |          |        | X  |
|                             | Casting                                                      |          |        | X  |
| Limbs                       | Normal movement and adjustment                               |          |        | X  |
| Knee Sliders                | Wires intact                                                 |          |        | X  |
|                             | Rubber returned to "at rest" position                        |          |        | X  |
| Pelvis                      | Broken                                                       |          |        | X  |
| Other                       |                                                              |          |        | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

09/29/2014  
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard  
Signature

09/29/2014  
Date

## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #125, PART 572, SUBPART O EXTERNAL DIMENSIONS |                                |                                                                                                                                              |                         |                    |
|-----------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                   | DESCRIPTION                    | DETAILS                                                                                                                                      | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                                           | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                            | 774.7-800.1             | 785.2              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 448.6              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 86.0               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 146.7              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 83.5               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 127.5              |
| G                                                                           | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 243.9-259.1             | 248.3              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 43.4               |
| I                                                                           | SHOULDER TO ELBOW LENGTH       | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2             | 285.4              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 192.9              |
| K                                                                           | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 520.7-546.1             | 542.7              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 356.8              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 394.2              |
| N                                                                           | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 414.0-439.4             | 428.5              |

| HYBRID III 5 <sup>th</sup> SN #125, PART 572, SUBPART O EXTERNAL DIMENSIONS, continued |                                                           |                                                         |                         |                    |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                              | DESCRIPTION                                               | DETAILS                                                 | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O                                                                                      | CHEST DEPTH WITHOUT JACKET                                | Measured 304.8 ± 5.1 mm above seat surface              | 175.3-190.5             | 185.2              |
| P                                                                                      | FOOT LENGTH                                               | Tip of toe to rear of heel                              | 218.5-233.7             | 219.0              |
| Q                                                                                      | STANDING HEIGHT                                           | (THEORETICAL)                                           | 1501.1                  | N/A                |
| R                                                                                      | BUTTOCK TO KNEE PIVOT LENGTH                              | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6             | 471.8              |
| S                                                                                      | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 141.2              |
| T                                                                                      | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 182.5              |
| U                                                                                      | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 301.6              |
| V                                                                                      | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 360.0              |
| W                                                                                      | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 93.9               |
| X                                                                                      | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 547.1              |
| Y                                                                                      | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 852.6              |
| Z                                                                                      | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 789.1              |
| AA                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 345.0              |
| BB                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 165.0              |

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/30/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
    X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- X 3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |
- X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- |                              |                  |
|------------------------------|------------------|
| Record findings and actions: | <u>No Damage</u> |
|------------------------------|------------------|

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result  |
|-------------------------------------|--------------------------------------------------|---------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 284 g   |
| Resultant versus time history curve | Unimodal                                         | Yes     |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes     |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -14.6 g |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel  
Signature

07/30/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

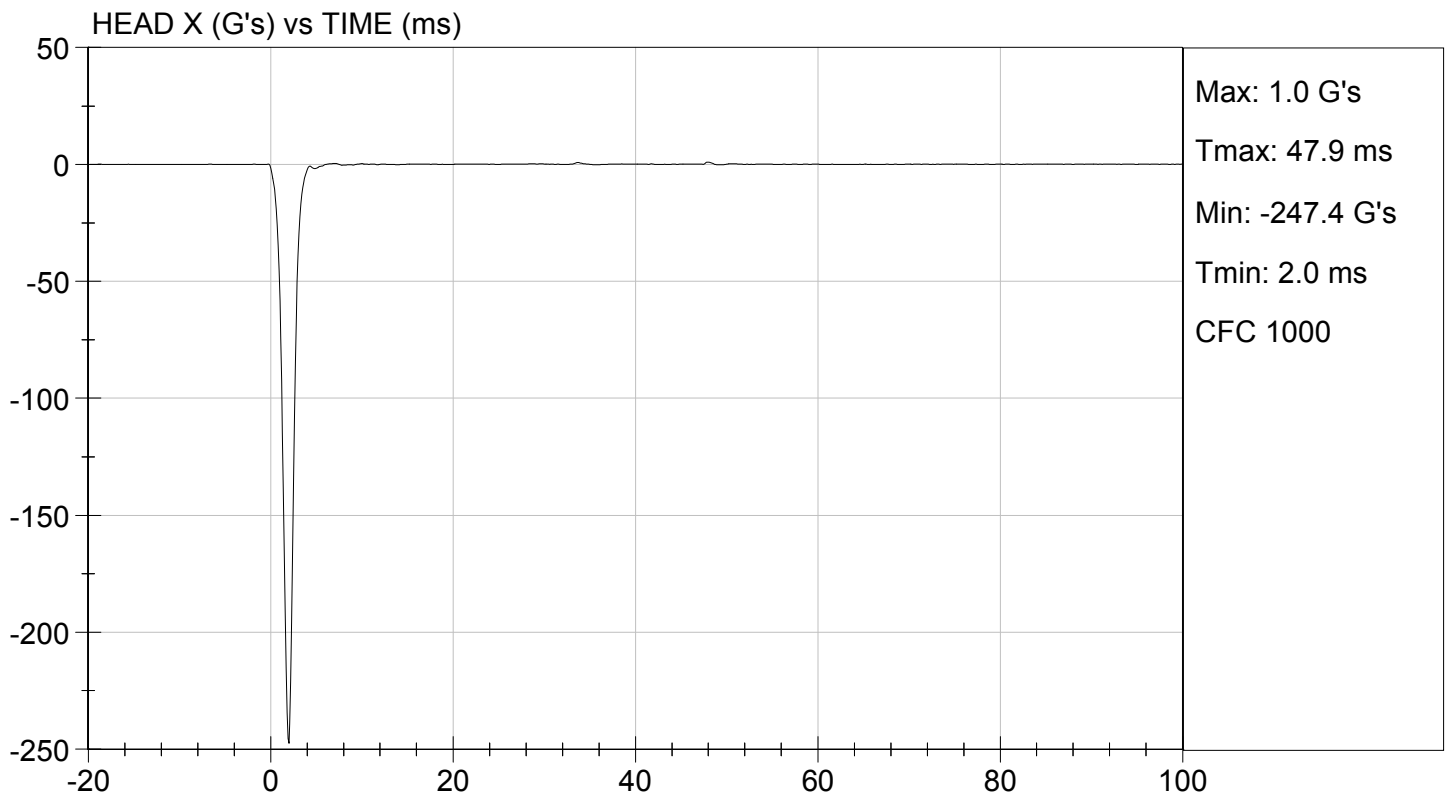
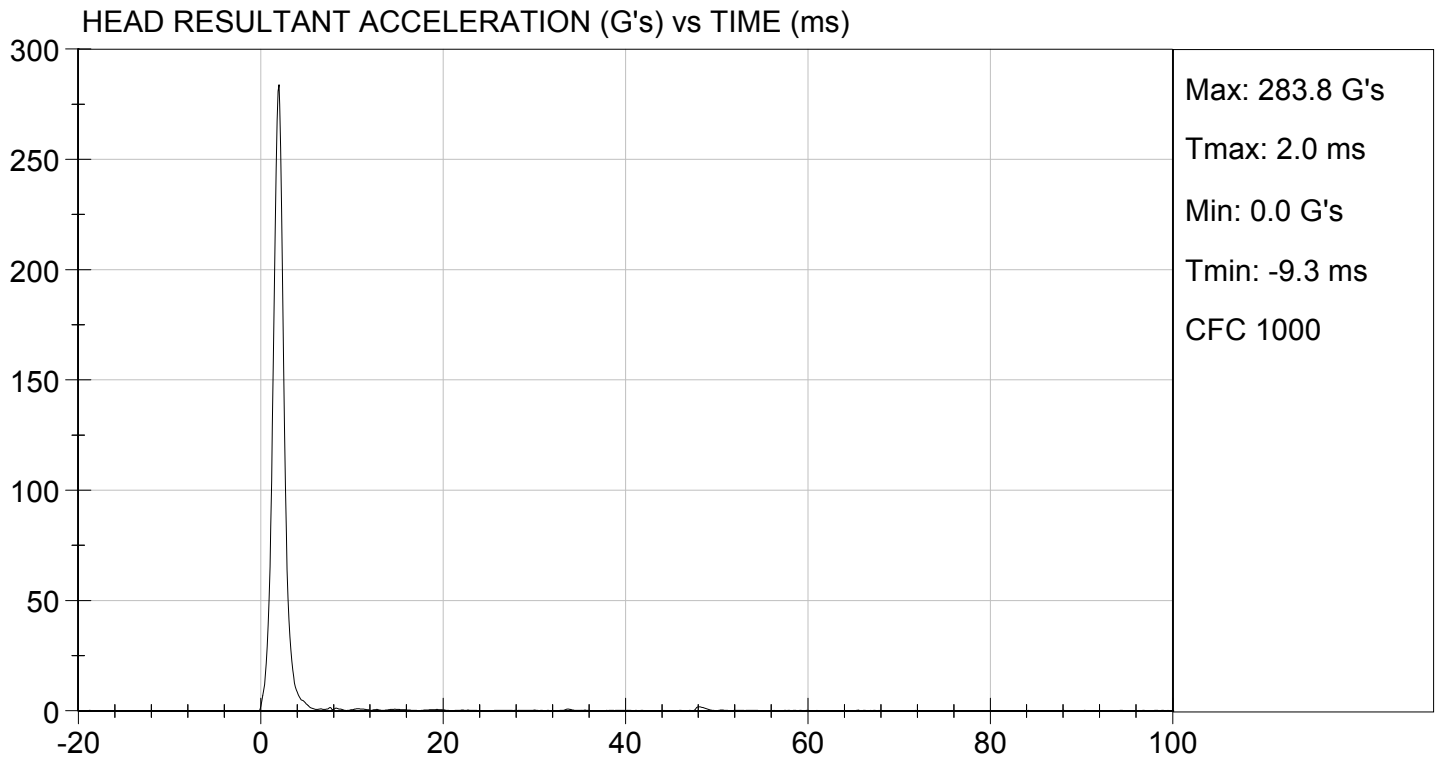
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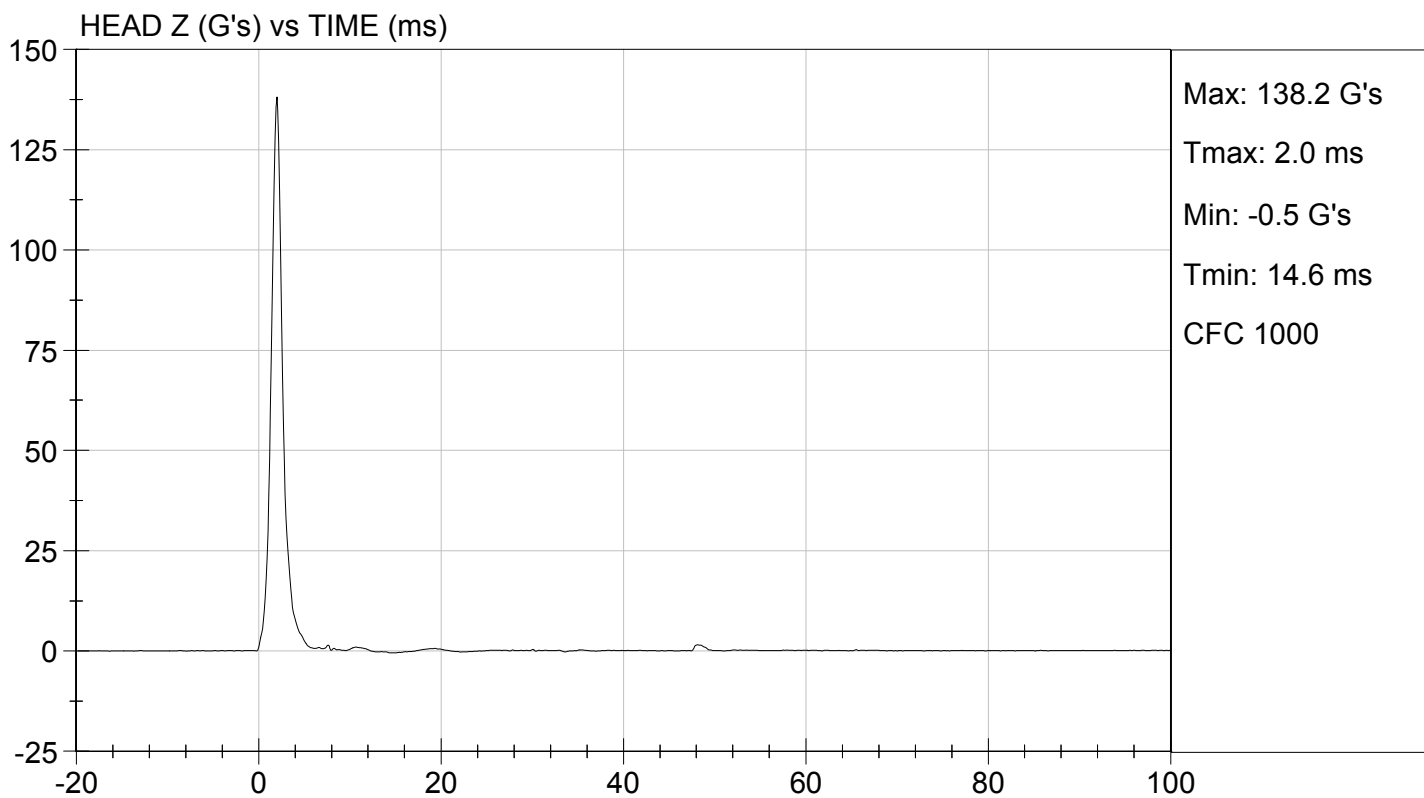
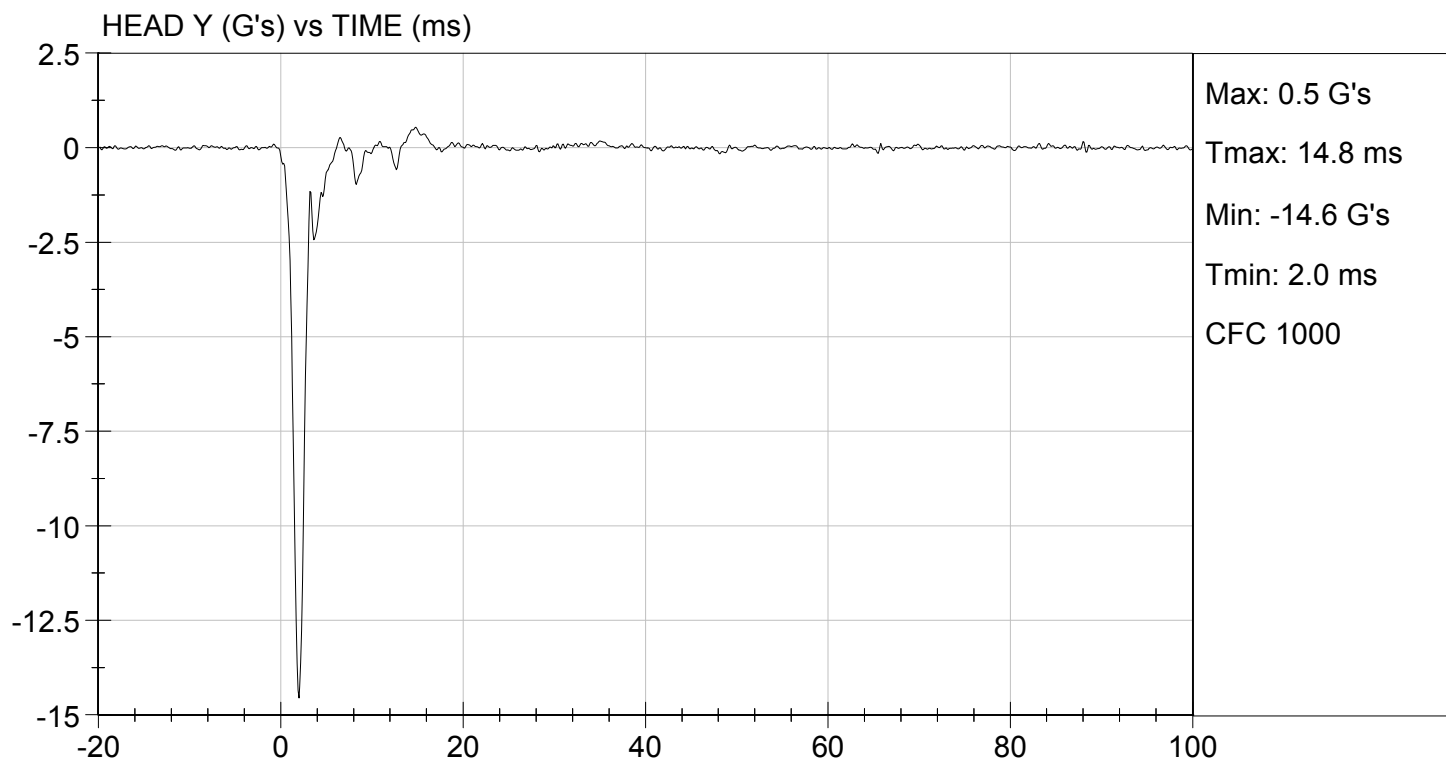
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 52     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 284    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -14.6  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

David Schoedel  
Laboratory Technician

07/30/2014  
Test Date

Jeff Leonard  
Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/29/2014

Technician: David Schoedel

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

X 1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
    X N/A, ONLY one neck test performed

X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                       | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 6.89 m/s $\leq$ speed $\leq$ 7.13 m/s                                                                               | 7.13 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                                | 2.5 m/s            |
|                                                  | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                                | 4.4 m/s            |
|                                                  | @ 30 ms | 5.8 m/s $\leq \Delta V \leq$ 7.0 m/s                                                                                | 5.9 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range<br>77° $\leq$ angle $\leq$ 91° | 78 Nm @ 79 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>80 ms $\leq$ time $\leq$ 100 ms                                                           | 81 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

David Schoedel  
Signature

07/29/2014  
Date

## MGA RESEARCH CORPORATION

## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 125

Test I.D: D142682

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 7.13   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.5    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.4    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 5.9    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 79     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 78     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 81     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |



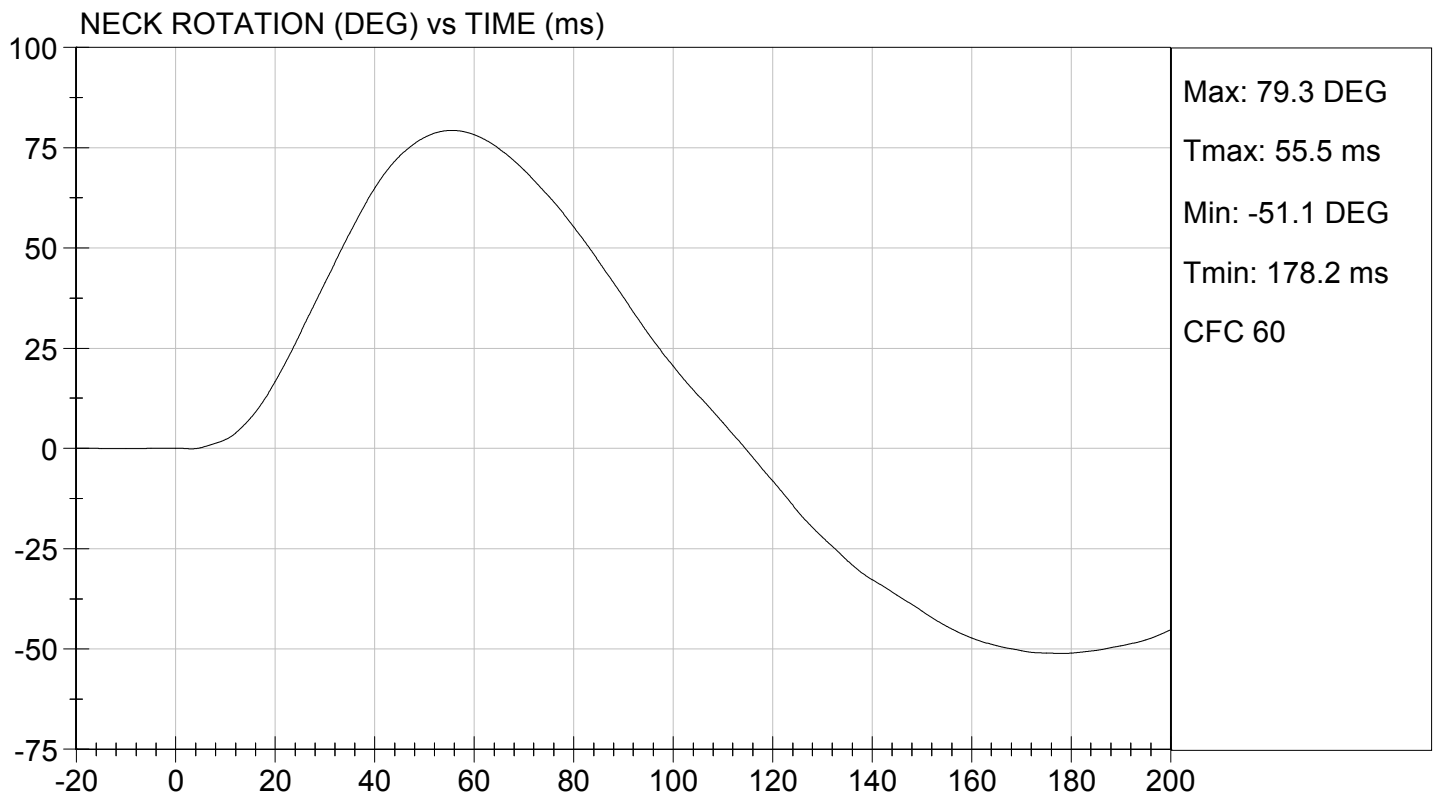
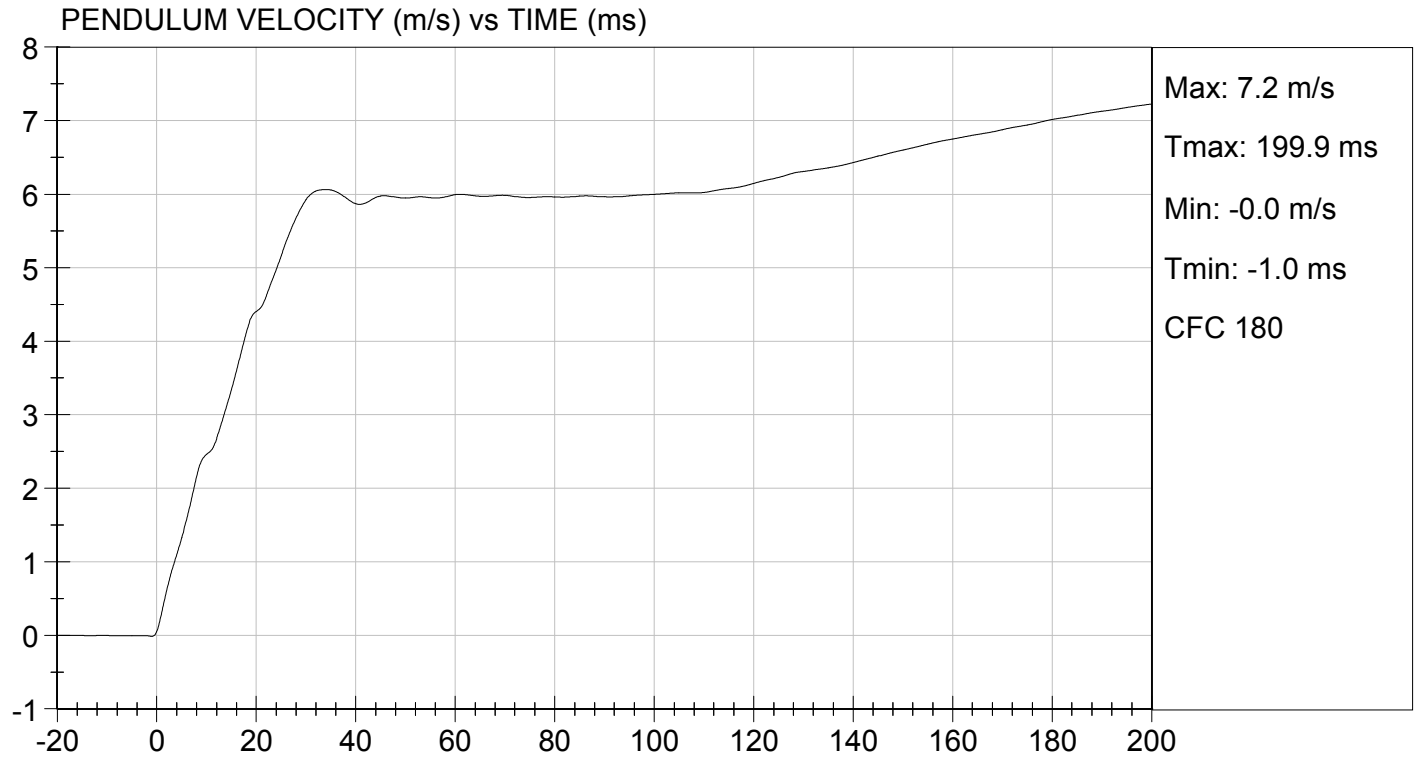
Laboratory Technician

07/29/2014

Test Date



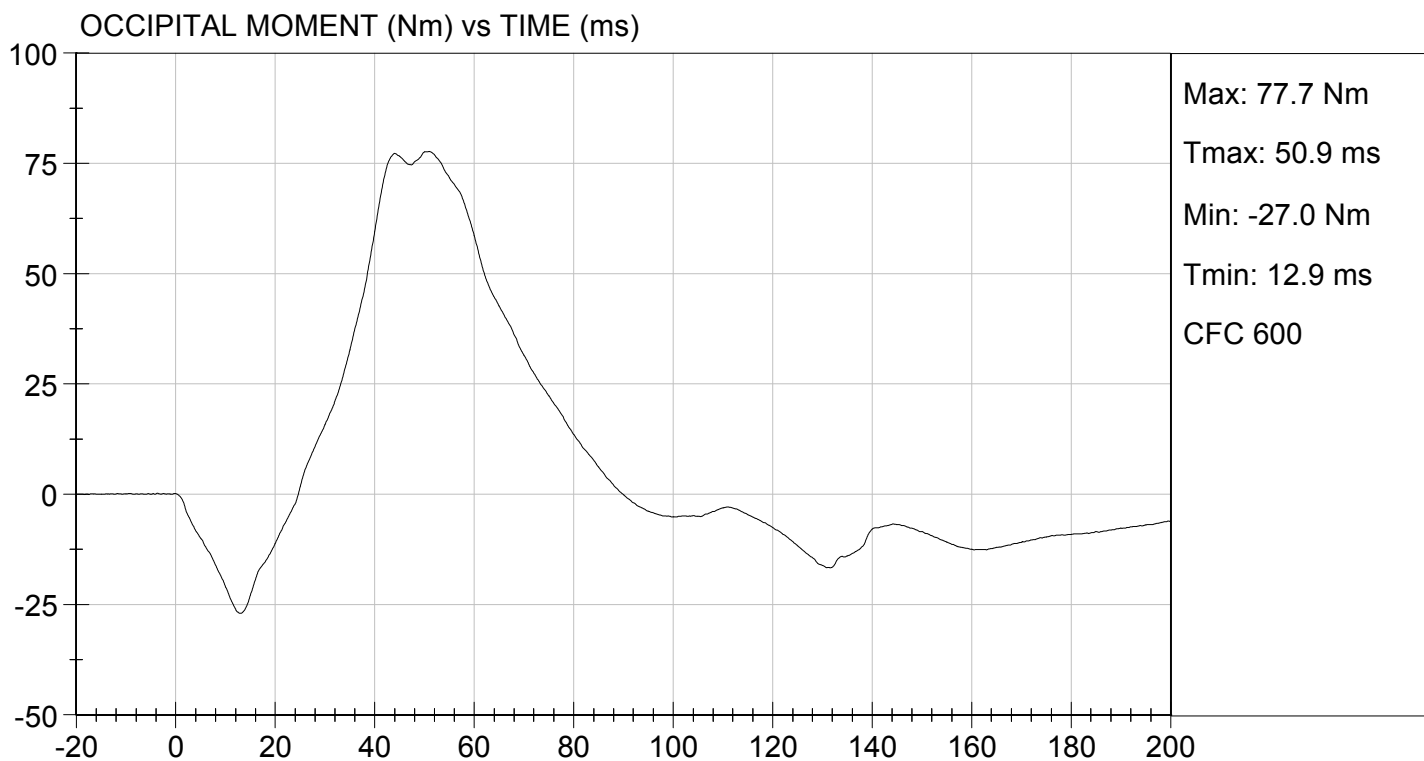
Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 23.40 ft/s, 7.13 m/s

TEST DATE: 07/29/2014  
TEST #: D142682



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/29/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last extension test. (572.137(q))  
X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.18 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.8 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.8 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.5 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -54 Nm @ 105 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 95 ms                |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

*David Schoedel*

Signature

07/29/2014

Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D142683

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.18   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.8    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.8    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.5    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 105    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -54    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 95     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

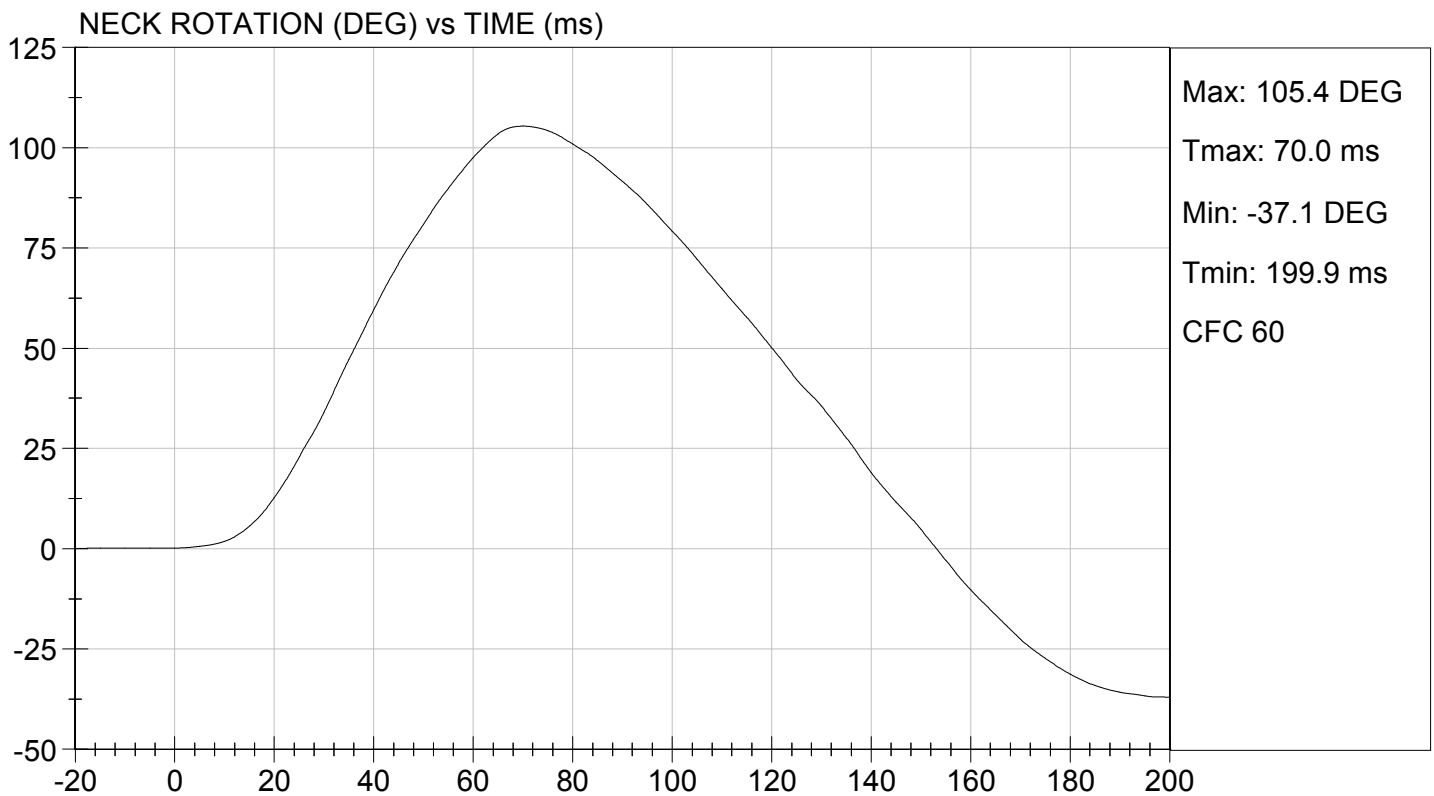
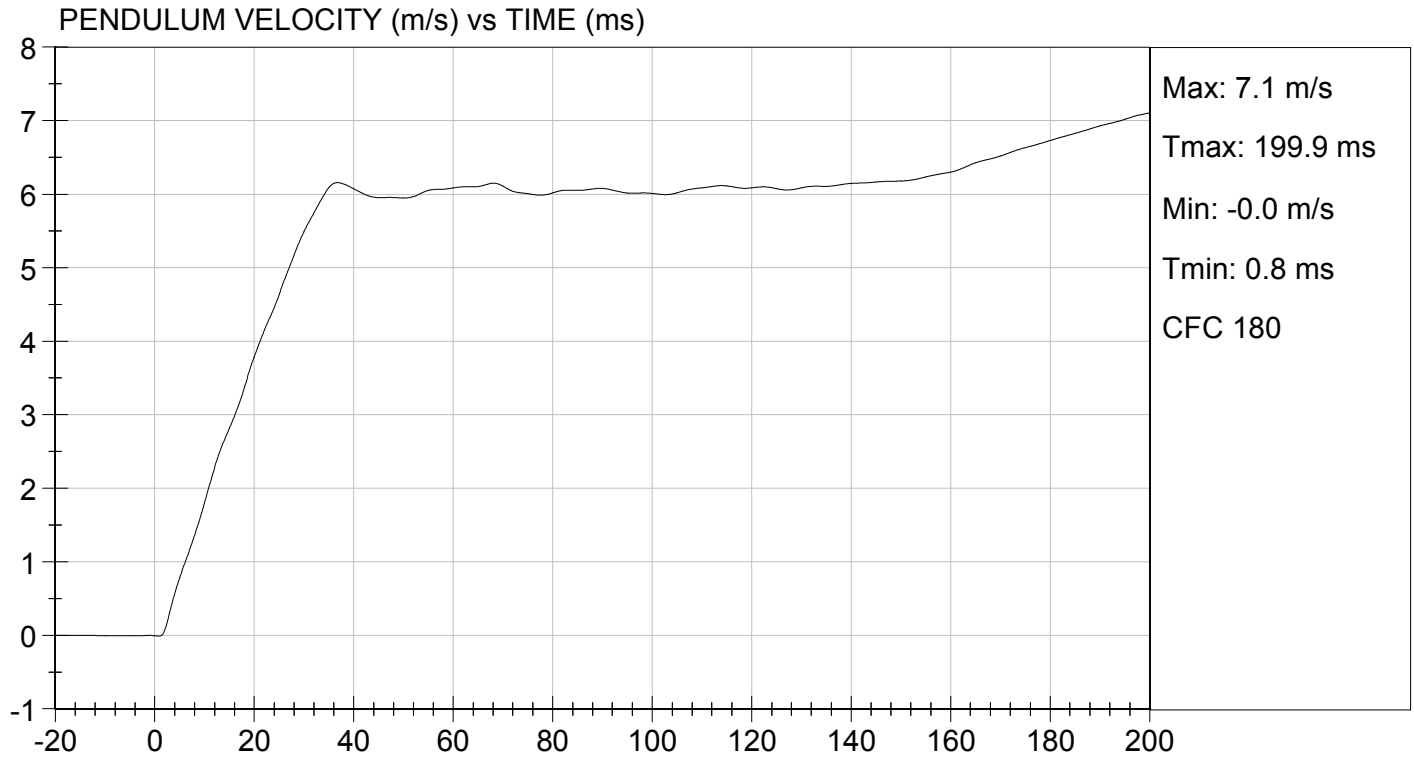
07/29/2014  
Test Date

Jeff Levanthal  
Approved By



TEST DESC: NECK EXTENSION  
VELOCITY: 20.30 ft/s, 6.18 m/s

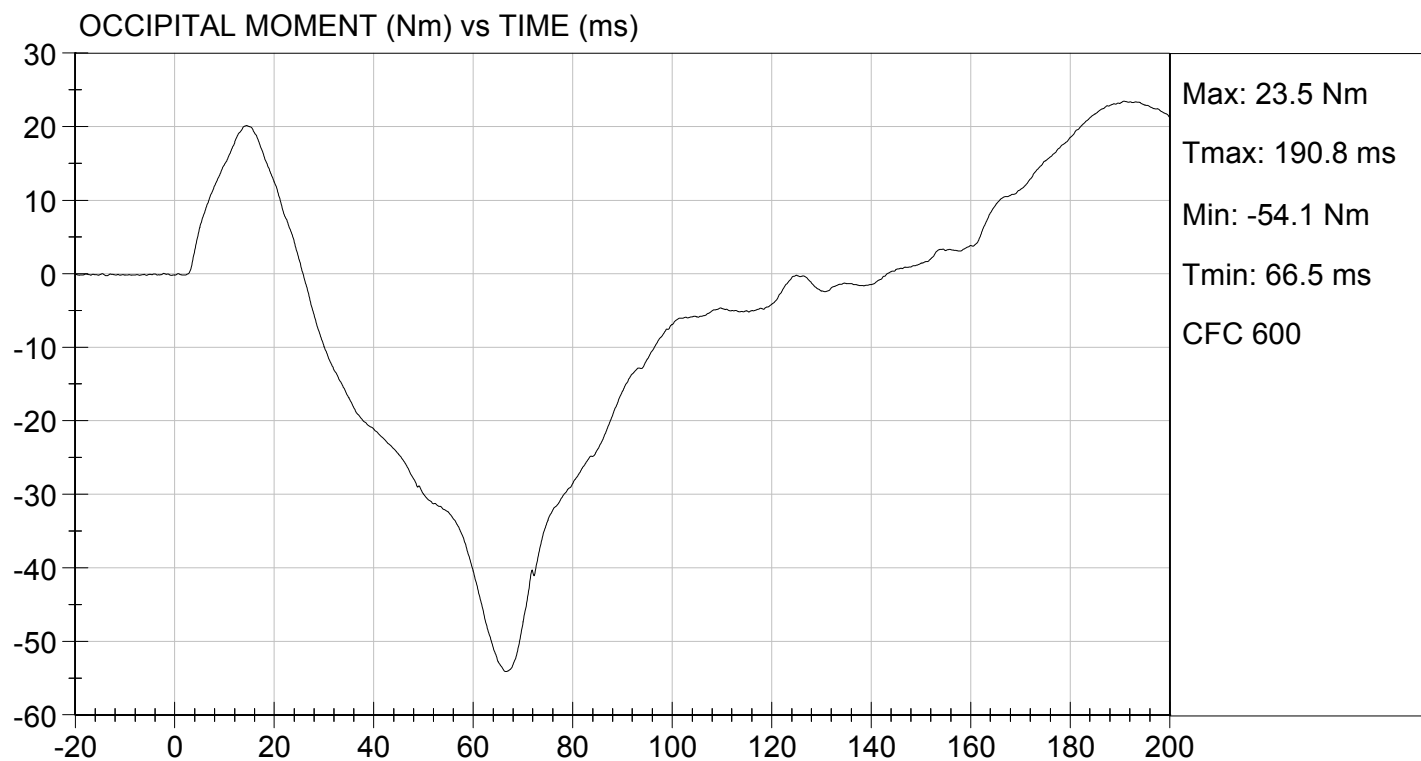
TEST DATE: 07/29/2014  
TEST #: D142683





TEST DESC: NECK EXTENSION  
VELOCITY: 20.30 ft/s, 6.18 m/s

TEST DATE: 07/29/2014  
TEST #: D142683



**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 125

Test Date: 07/30/2014

Technician: David Schoedel

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- ☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |

- ☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No Damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

☐ - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

- X   16. Complete the following table:  
Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.77 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 52 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4155 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq 4600 \text{ N}$                               | 4208 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

- X   17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

*David Schoedel*

Signature

07/30/2014

Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D142684

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 52     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.77   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 52     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4155   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4208   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

07/30/2014

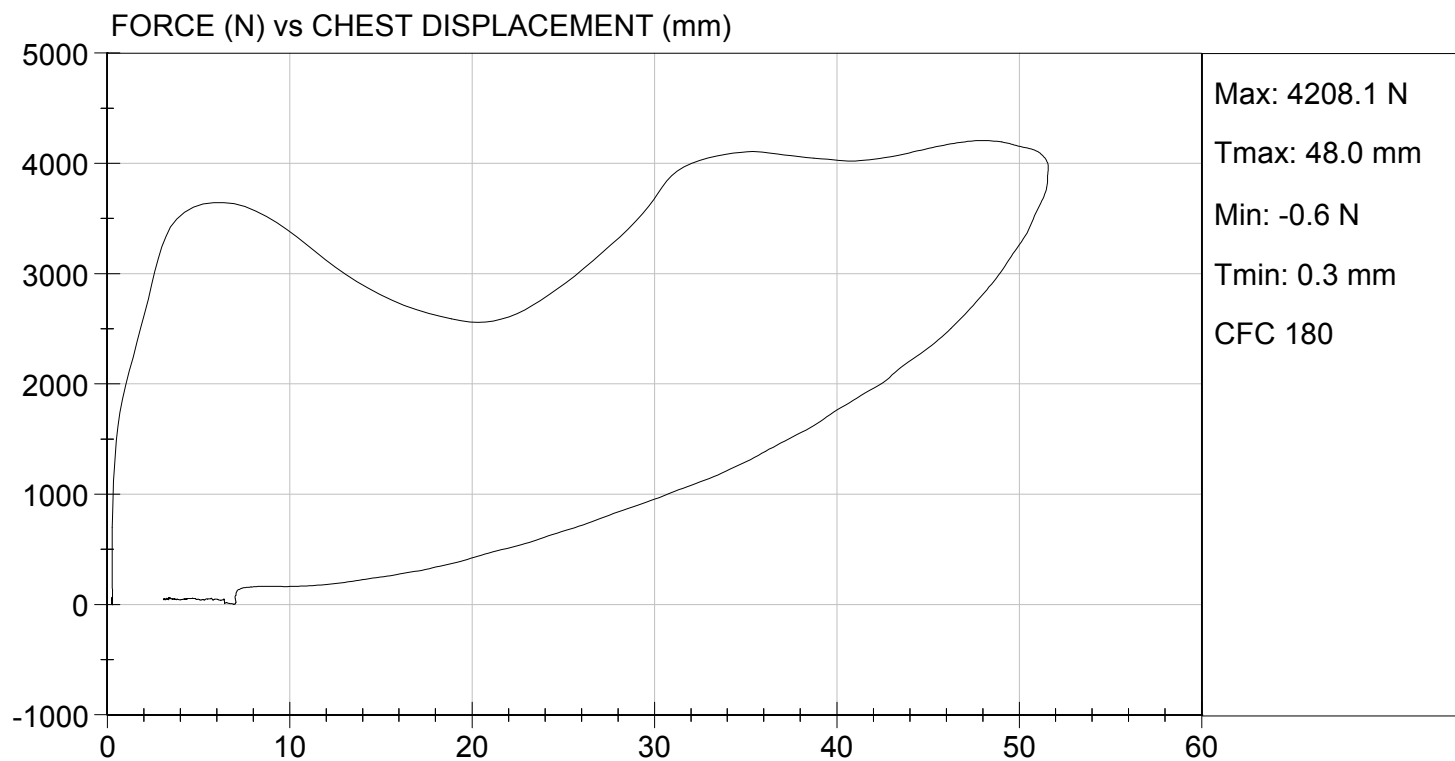
Test Date

Jeff Leonard  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 07/30/2014  
TEST #: D142684



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/29/2014

Technician: Joseph Radke

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
☒ N/A, ONLY one torso flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
☐ With legs below femurs.  
☒ Without legs below femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- ☒ 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- ☒ 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):                     See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 20 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.9 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 334 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 23 deg      |

Joseph Radke  
 Signature

07/29/2014  
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D142687

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 20     | Pass      |
| Return Angle                 | deg   | +/- 8         | 23     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 334    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.9    | Pass      |
| Overall Result               |       |               |        | Pass      |

Joseph Radke  
Laboratory Technician

07/29/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/29/2014

Technician: David Schoedel

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.10 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3453 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

*David Schoedel*

Signature

07/29/2014

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D142686

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.4   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.10   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3453   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

*David Schoedel*

Laboratory Technician

07/29/2014

Test Date

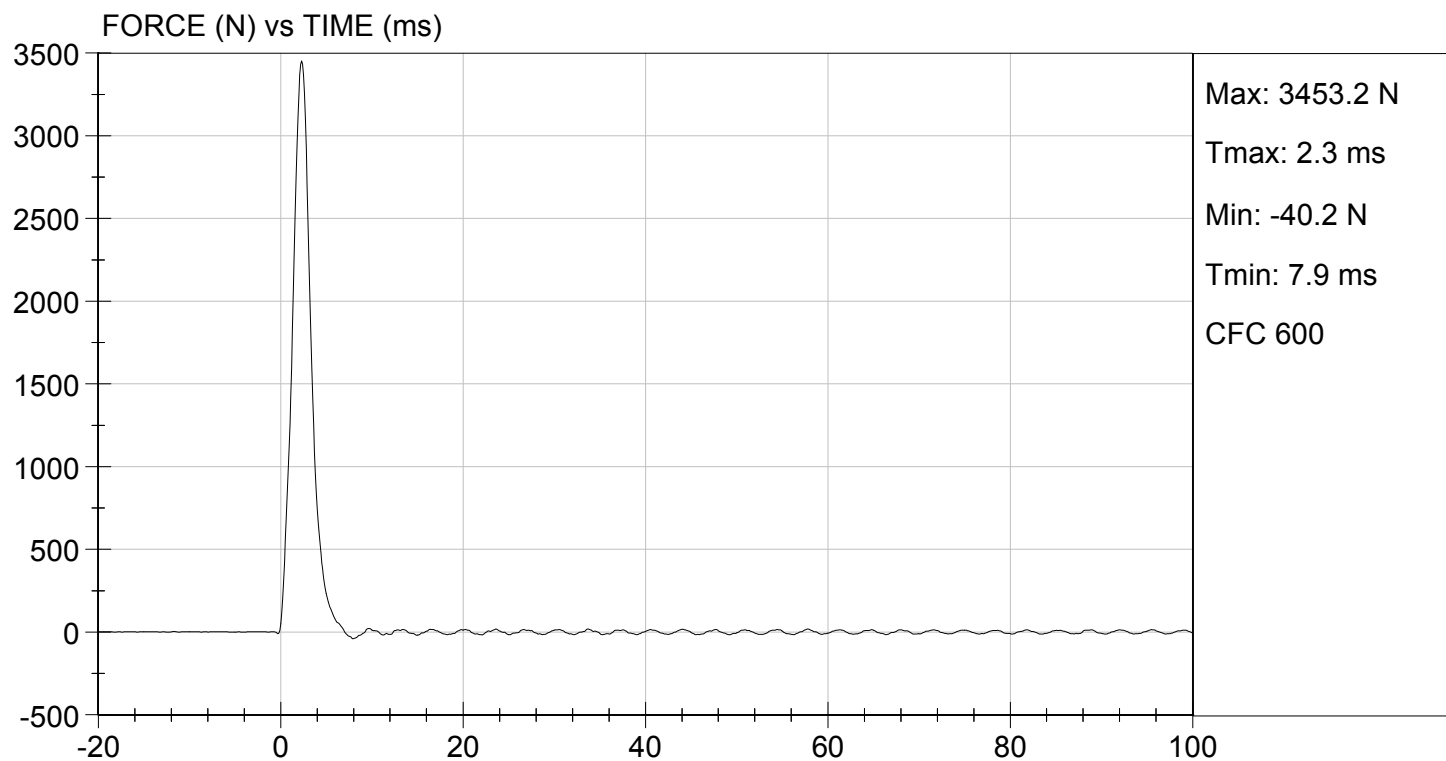
*Jeff Leonard*

Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.89 ft/s, 2.10 m/s

TEST DATE: 07/29/2014  
TEST #: D142686



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 07/29/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>52%</u>    |
| Record the minimum humidity:    | <u>47%</u>    |

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3607 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

David Schoedel  
Signature

07/29/2014  
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D142685

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.4   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3607   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

David Schoedel

Laboratory Technician

07/29/2014

Test Date

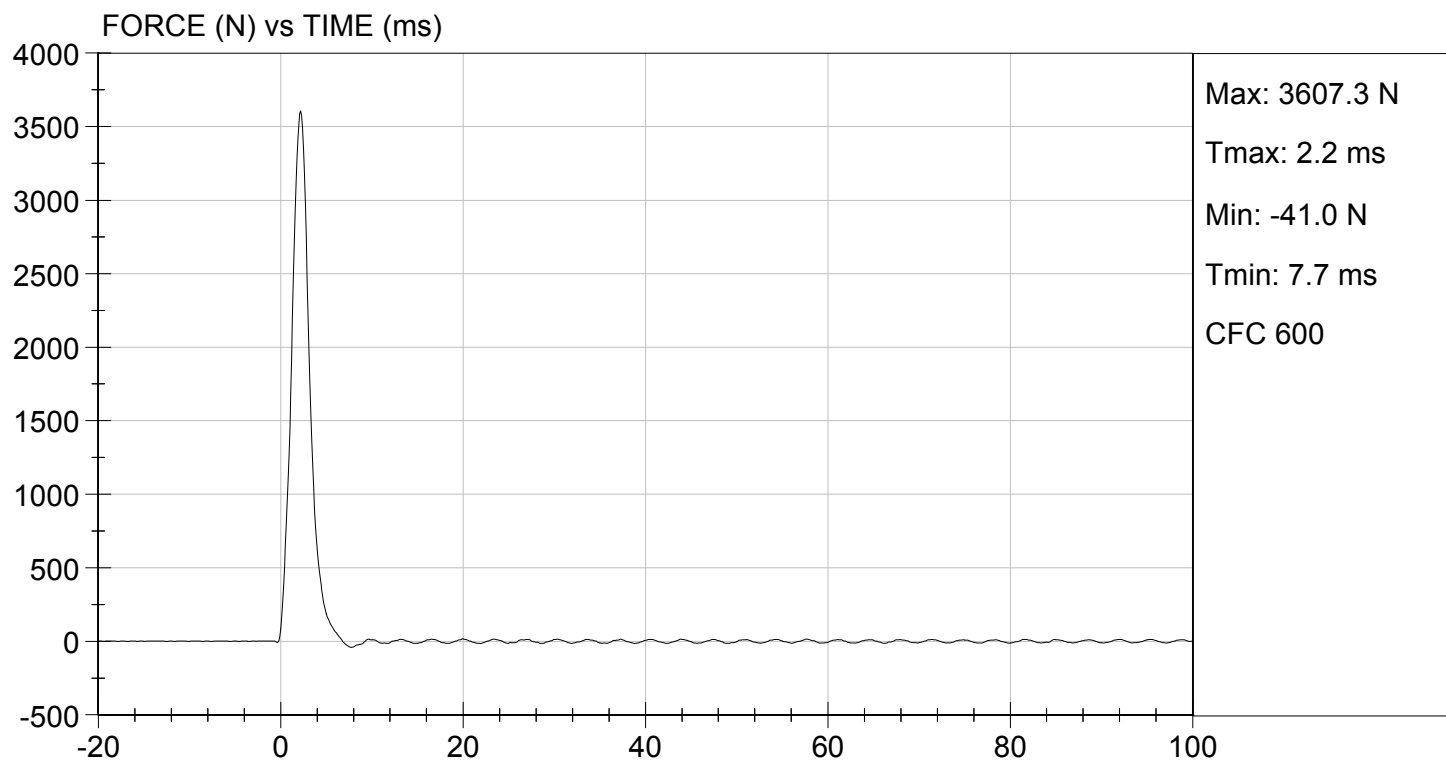
Jeff Leonard

Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 07/29/2014  
TEST #: D142685



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P82603     | 02/04/2014               | 08/04/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P82604     | 02/04/2014               | 08/04/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P82605     | 02/04/2014               | 08/04/2014               |
| NECK TRANSDUCER                       | Denton       | 1716                | 1673       | 05/27/2014               | 11/27/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P82607     | 02/04/2014               | 08/04/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P82609     | 02/04/2014               | 08/04/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P82610     | 02/04/2014               | 08/04/2014               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 125        | 02/10/2014               | 08/10/2014               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 2024       | 07/23/2014               | 01/23/2015               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 2025       | 07/23/2014               | 01/23/2015               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AH467      | 2/20/2014                | 8/20/2014                |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 5/1/2014                 | 11/1/2014                |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 7/2/2014                 | 1/2/2015                 |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 4/15/2014                | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 4/15/2014                | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X  1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- X  3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X  4. Accelerometers and their respective mounts are smooth and clean.
- X  5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- X  7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 40.9 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result  |
|-------------------------------------|--------------------------------------------------|---------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 277 g   |
| Resultant versus time history curve | Unimodal                                         | Yes     |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes     |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -10.0 g |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel  
Signature

09/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test ID:** D143401

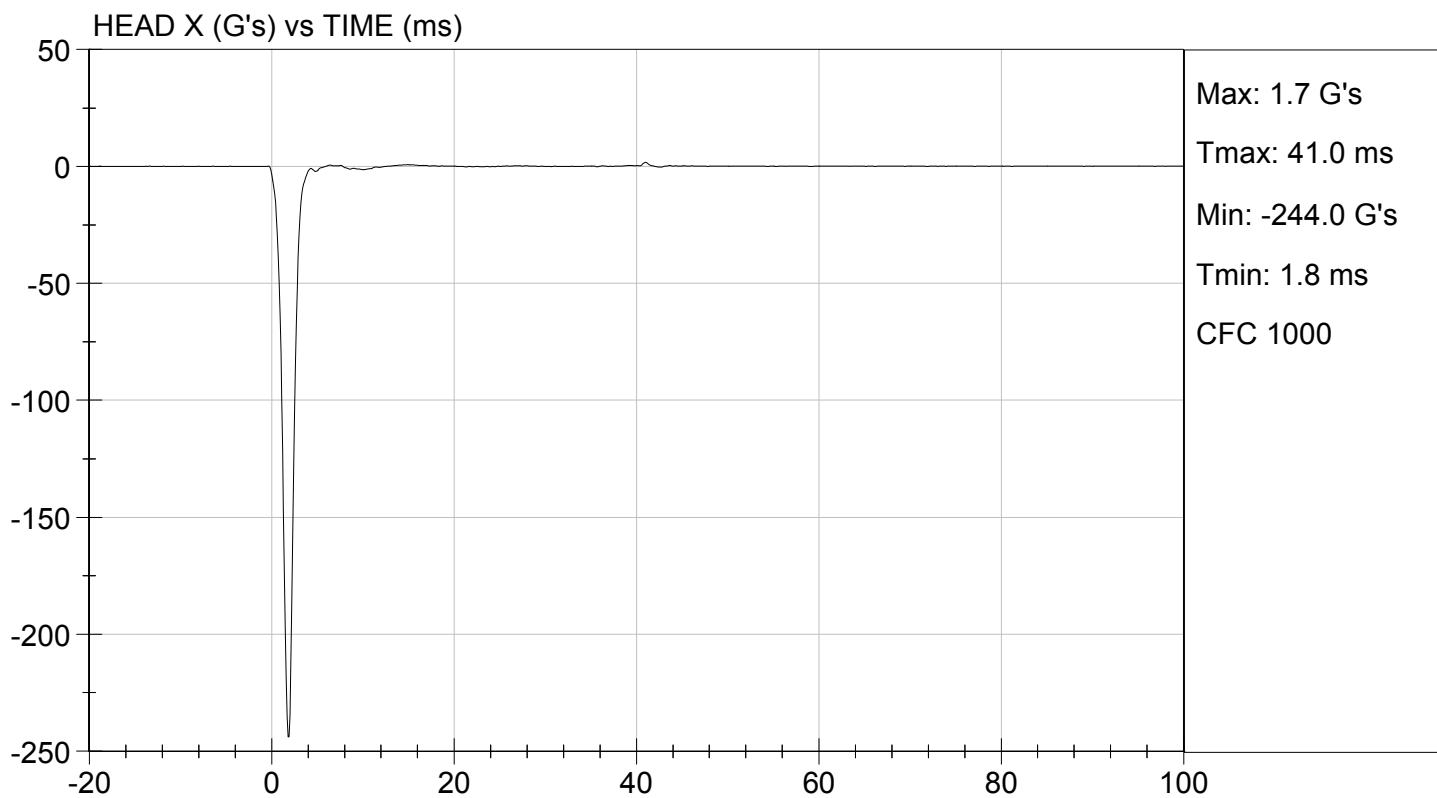
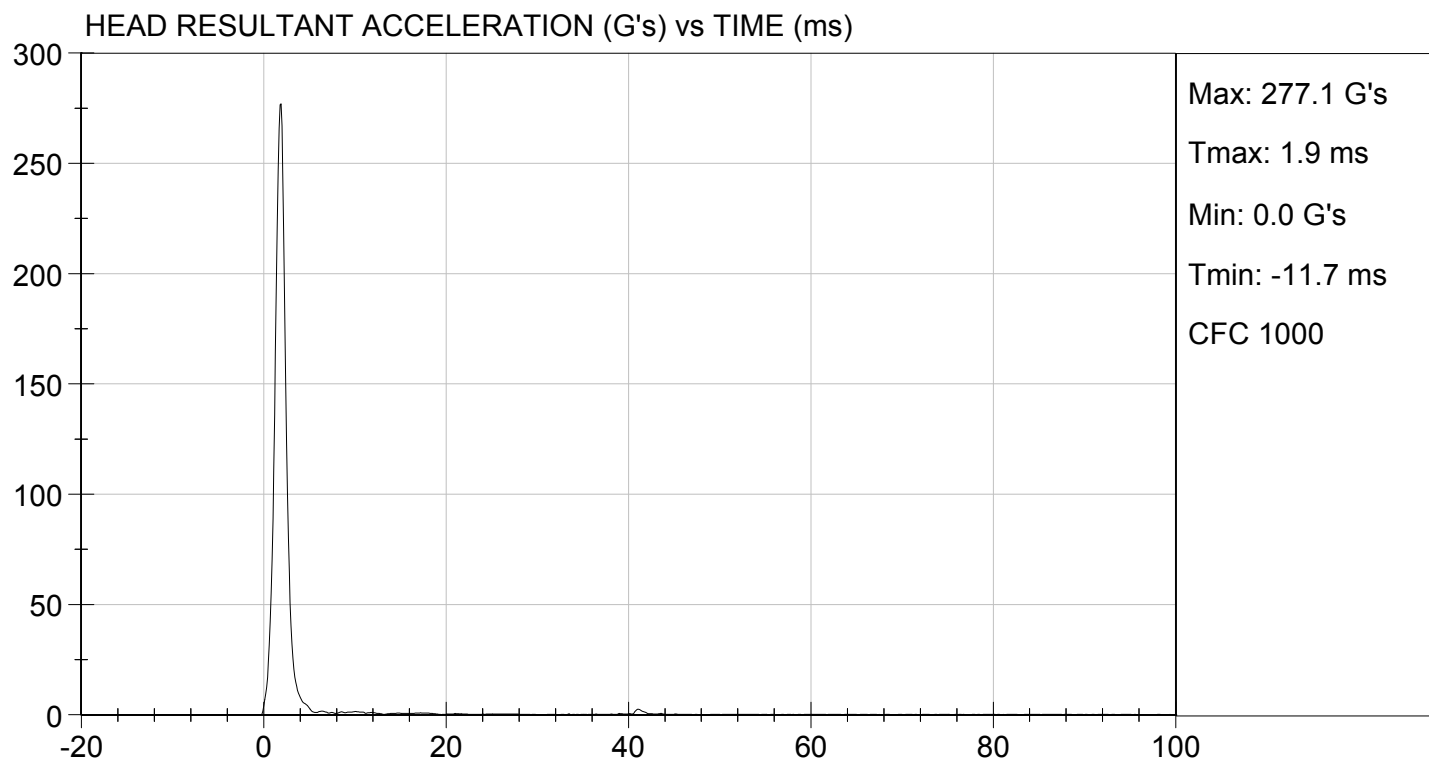
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 47     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 277    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -10.0  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

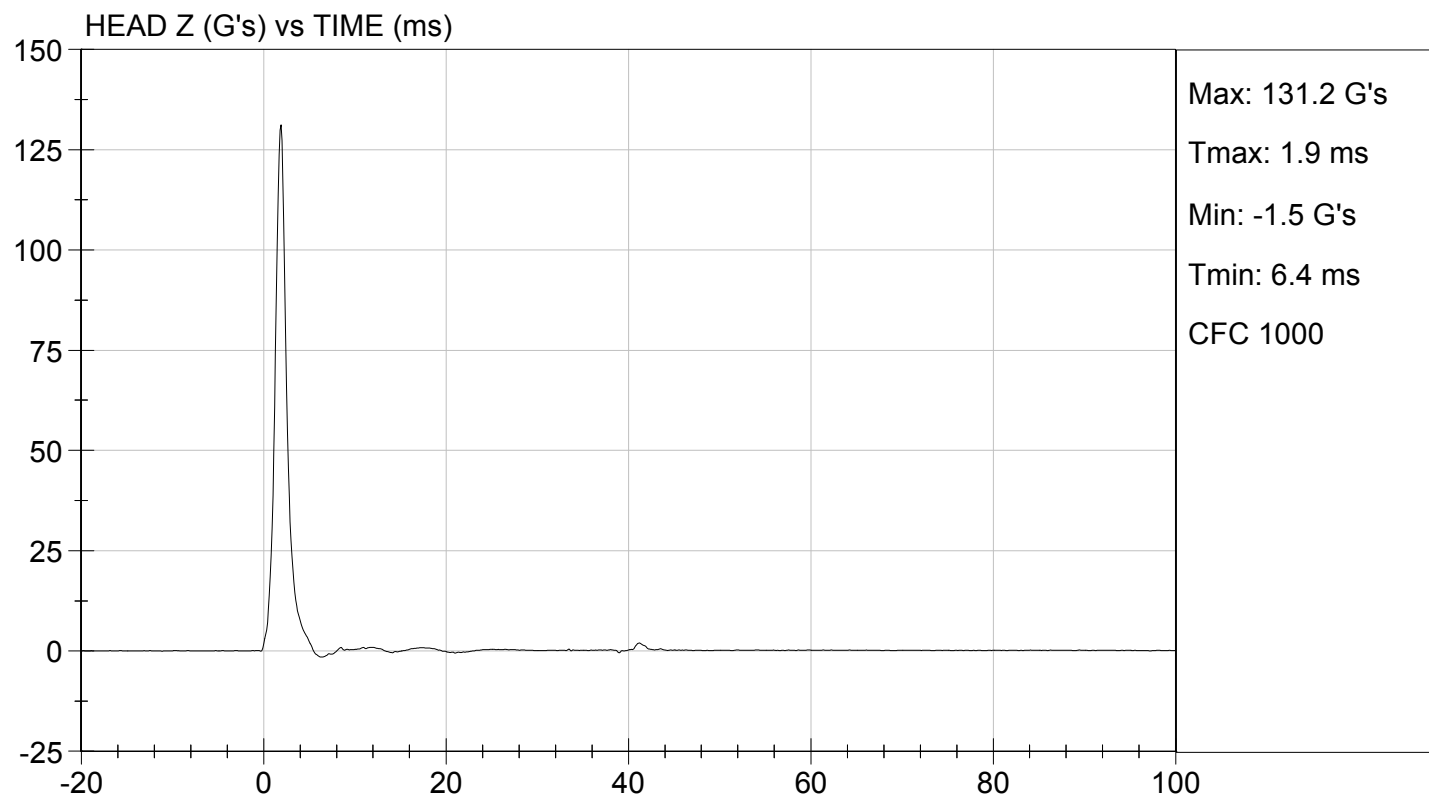
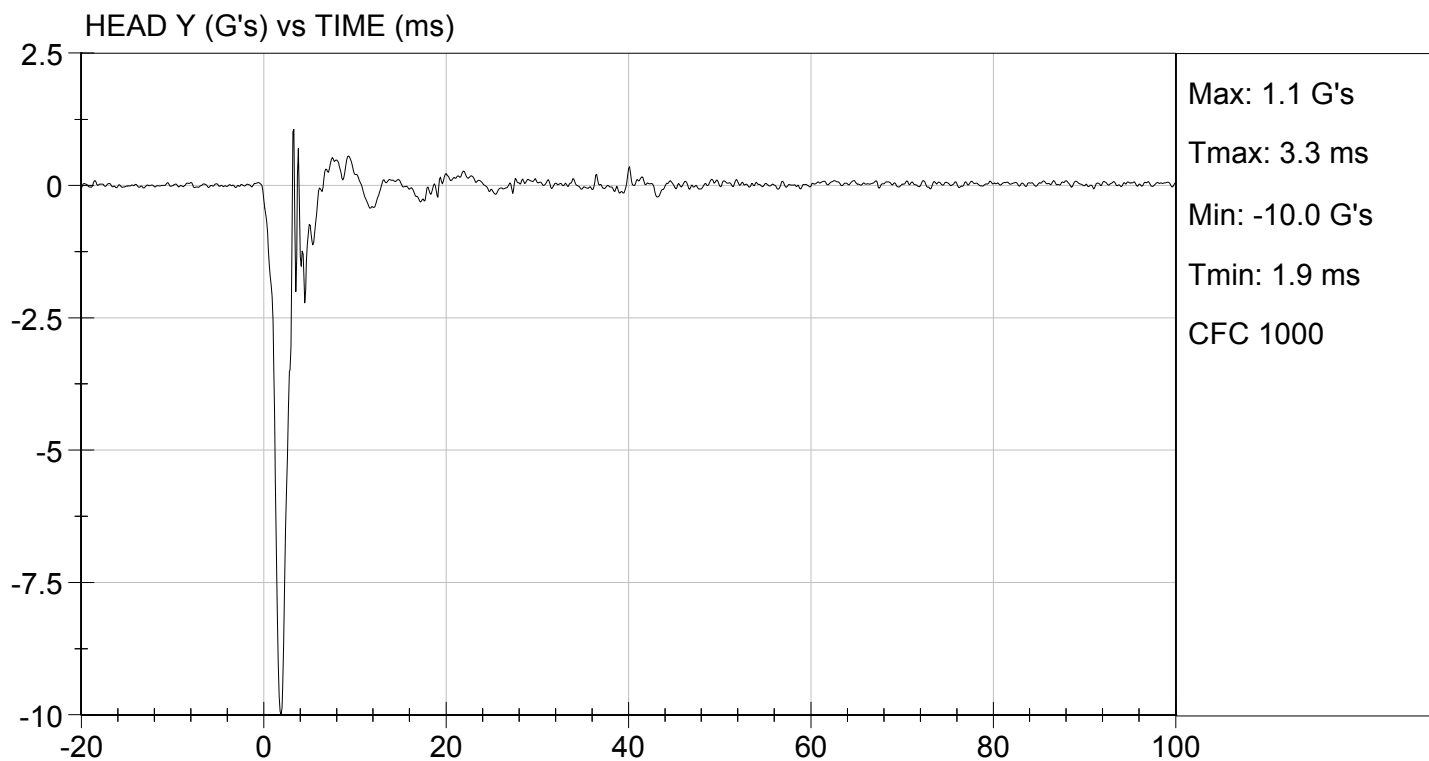
David Schoedel  
Laboratory Technician

09/29/2014

Test Date

Jeff Leonard  
Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: David Schoedel

       Pre test calibration  
  X   Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

  X   1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
         X   N/A, ONLY one neck test performed

  X   2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

  X   3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

  X   4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

  X   5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

  X   6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                       | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 6.89 m/s $\leq$ speed $\leq$ 7.13 m/s                                                                               | 7.06 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                                | 2.5 m/s            |
|                                                  | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                                | 4.5 m/s            |
|                                                  | @ 30 ms | 5.8 m/s $\leq \Delta V \leq$ 7.0 m/s                                                                                | 6.1 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range<br>77° $\leq$ angle $\leq$ 91° | 74 Nm @ 77 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>80 ms $\leq$ time $\leq$ 100 ms                                                           | 89 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

David Schoedel  
Signature

09/29/2014  
Date

## MGA RESEARCH CORPORATION

## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 125

Test I.D: D143402

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.4   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 7.06   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.5    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.5    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 6.1    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 77     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 74     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 89     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |



Laboratory Technician

09/29/2014

Test Date

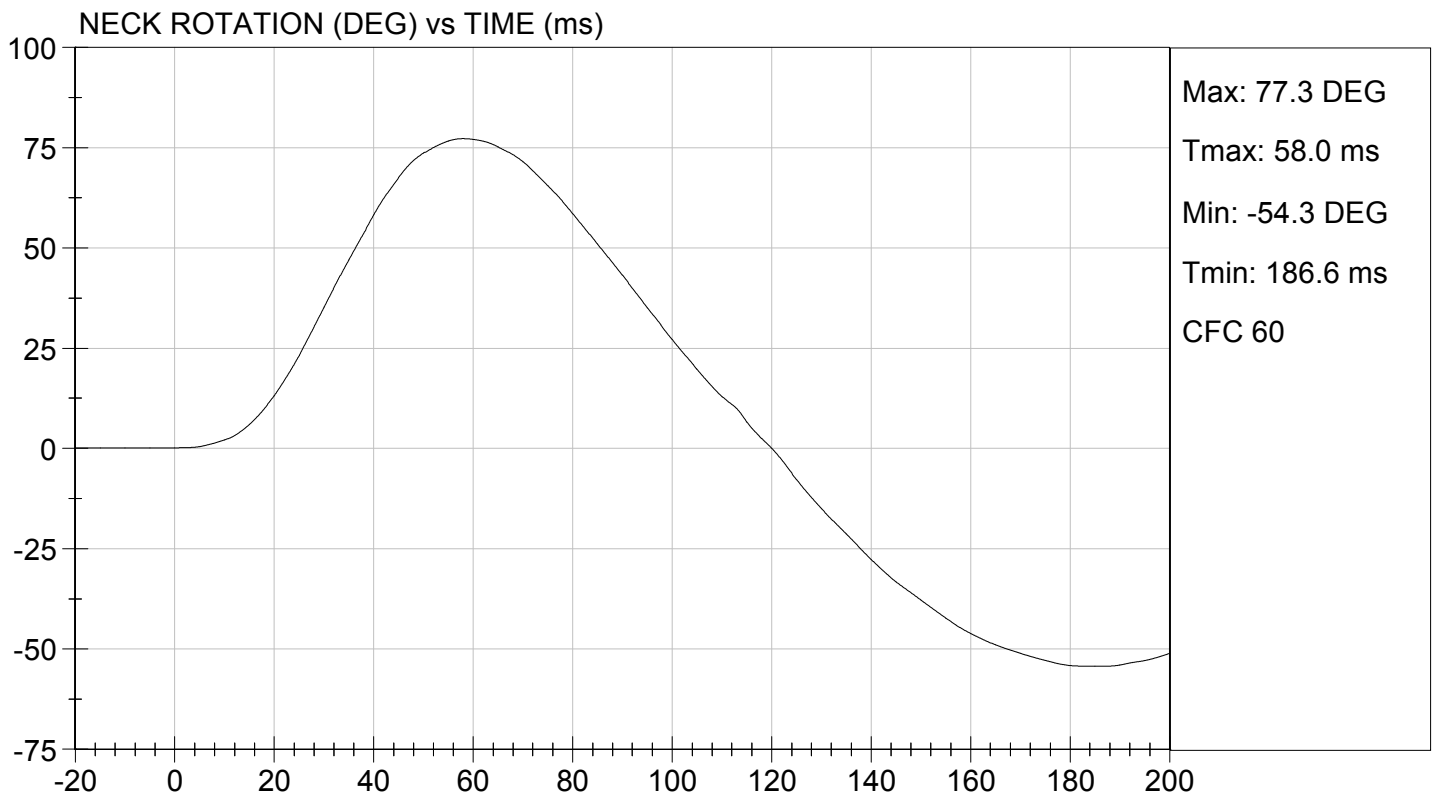
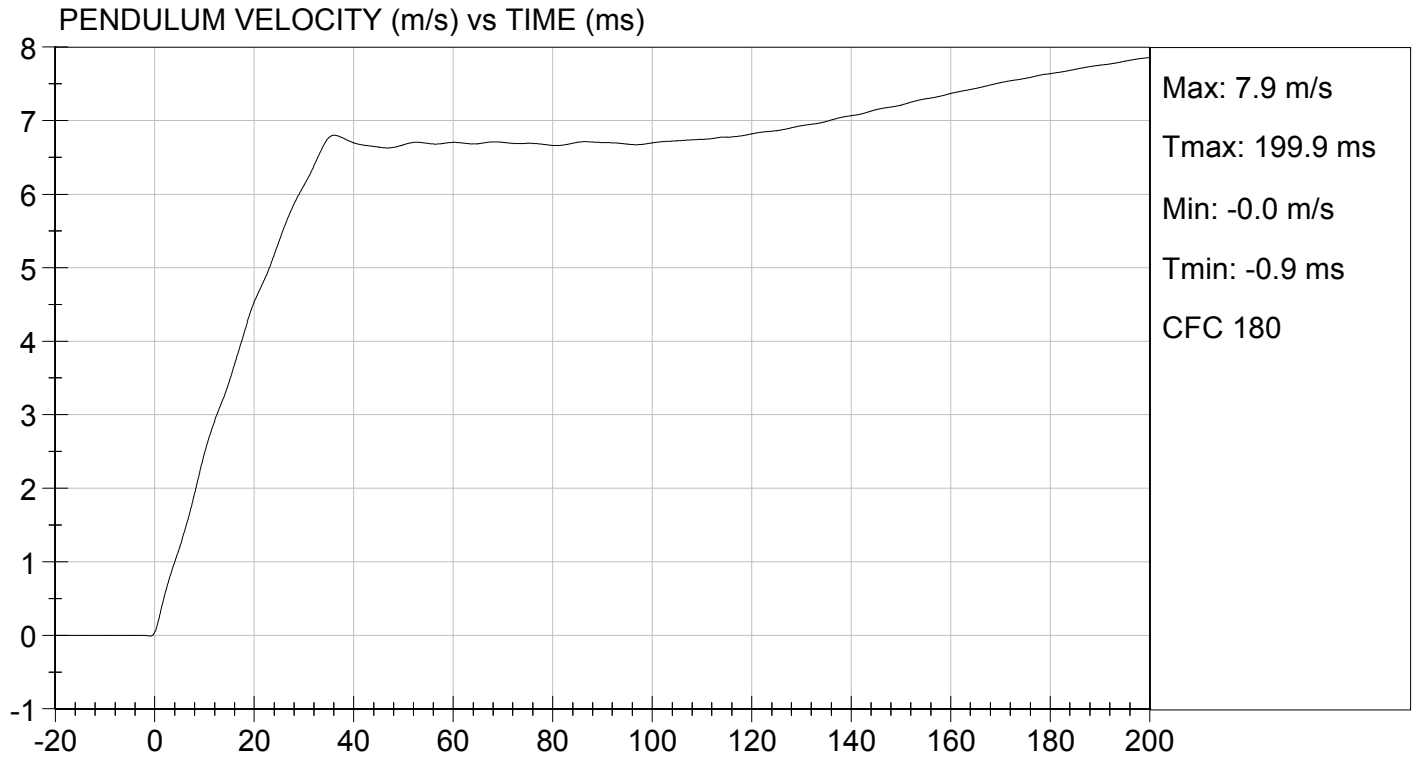


Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 23.15 ft/s, 7.06 m/s

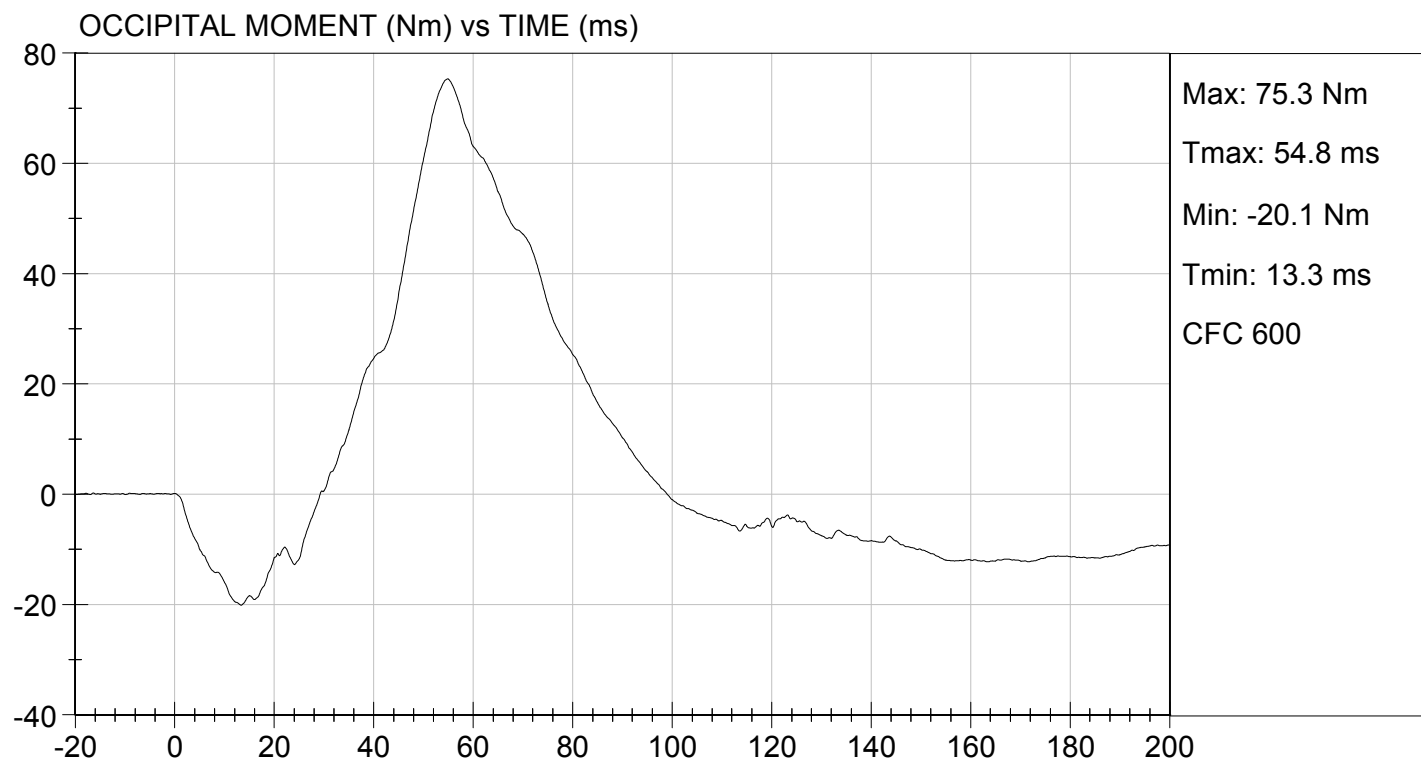
TEST DATE: 09/29/2014  
TEST #: D143402





TEST DESC: NECK FLEXION  
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 09/29/2014  
TEST #: D143402



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

X  1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 X  N/A, ONLY one neck test performed

X  2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))

X  3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

X  4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X  5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).

Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.

X  6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.19 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.8 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.7 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.3 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -55 Nm @ 106 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 99 ms                |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

09/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D143403

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.19   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.8    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.7    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.3    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 106    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -55    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 99     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

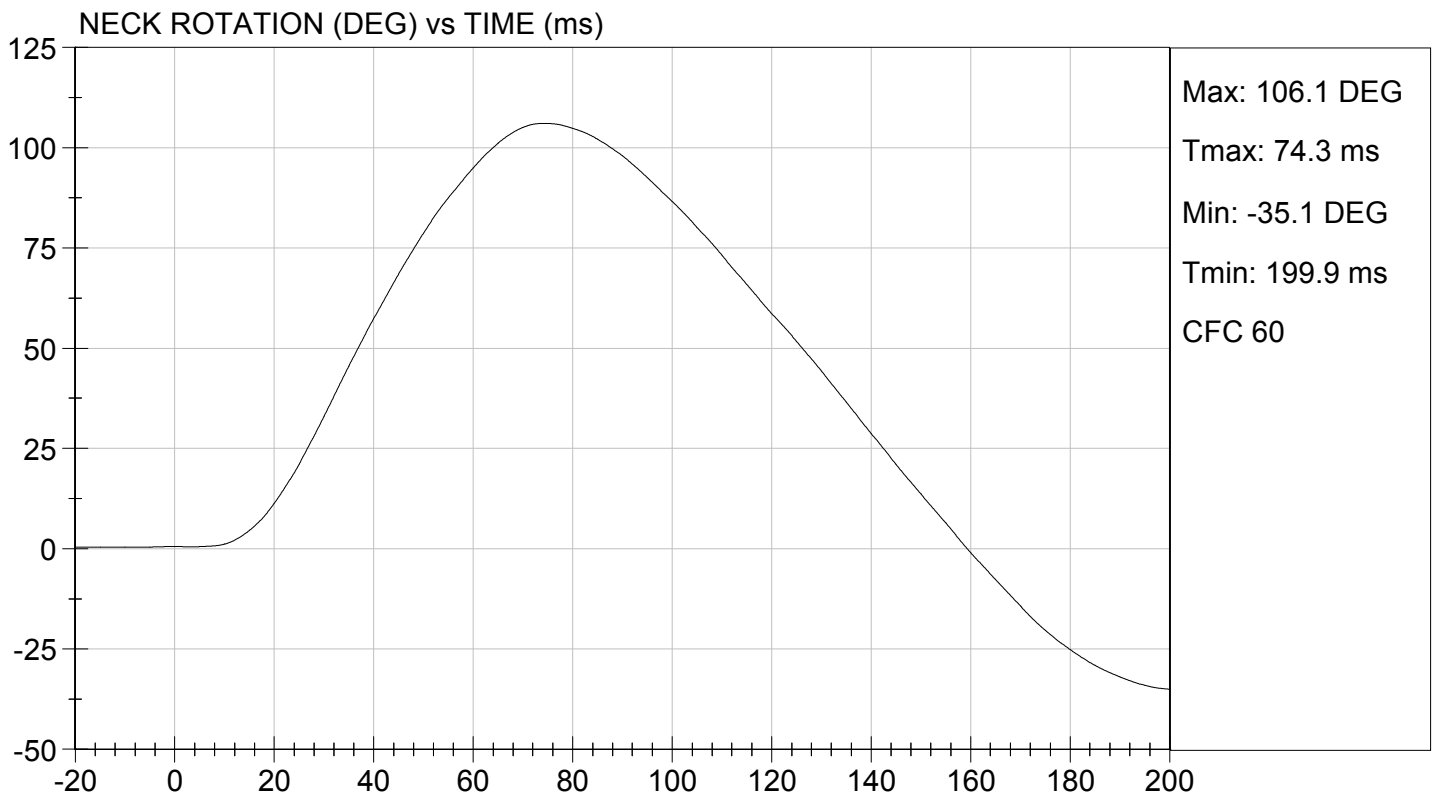
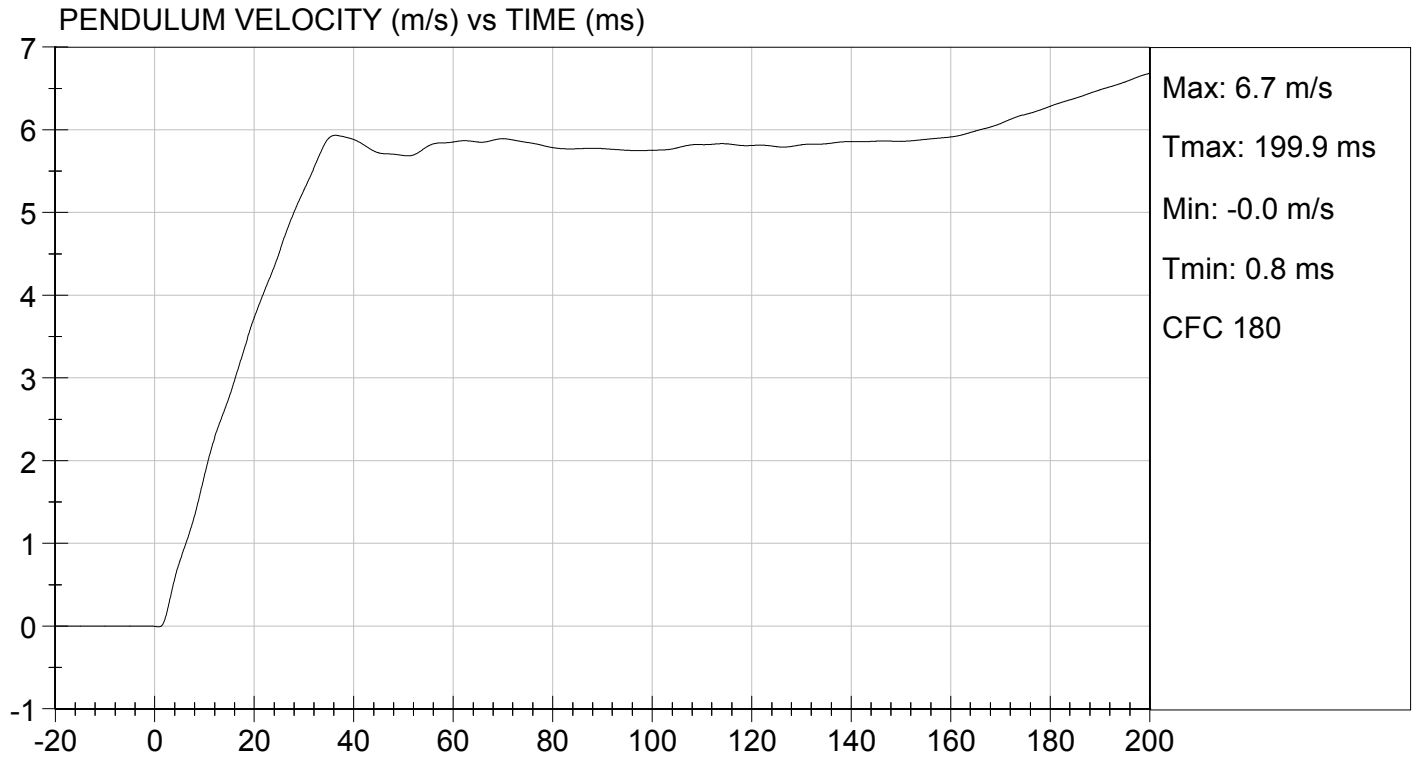
09/29/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: NECK EXTENSION  
VELOCITY: 20.30 ft/s, 6.19 m/s

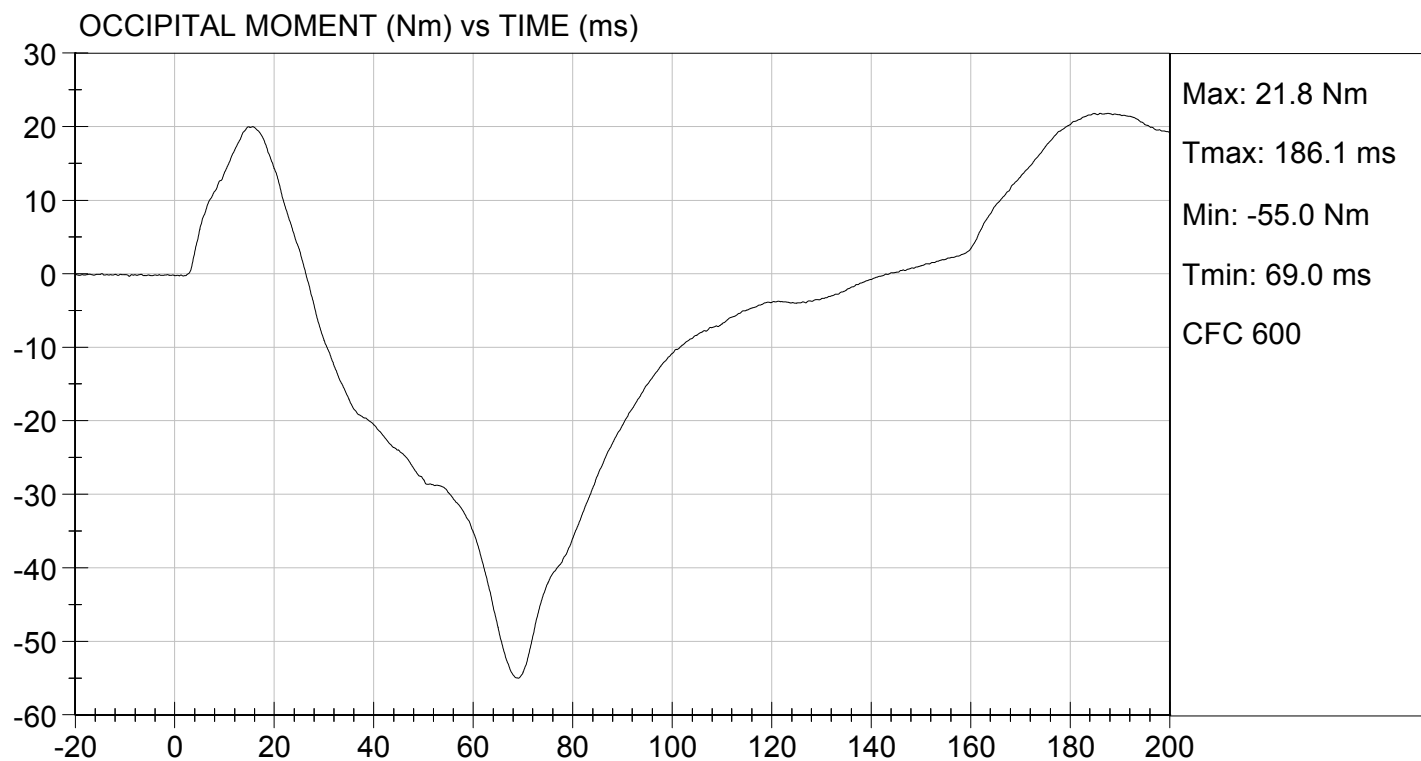
TEST DATE: 09/29/2014  
TEST #: D143403





TEST DESC: NECK EXTENSION  
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 09/29/2014  
TEST #: D143403



**DATA SHEET B6**  
**THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: Jack Coleman

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X  1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
 X  N/A, ONLY one thorax impact test performed
- X  2. The test fixture conforms to the specifications in Figure 11B.
- X  3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- X  4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- X  5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X  - No Damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

     - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

- X   16. Complete the following table:  
Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.77 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 53 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4220 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq 4600 \text{ N}$                               | 4241 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 71%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

- X   17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Jack Coleman  
Signature

09/29/2014  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D143404

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 20.8   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 44     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.77   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 53     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4220   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 71     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4241   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

Jack Coleman  
Laboratory Technician

09/29/2014

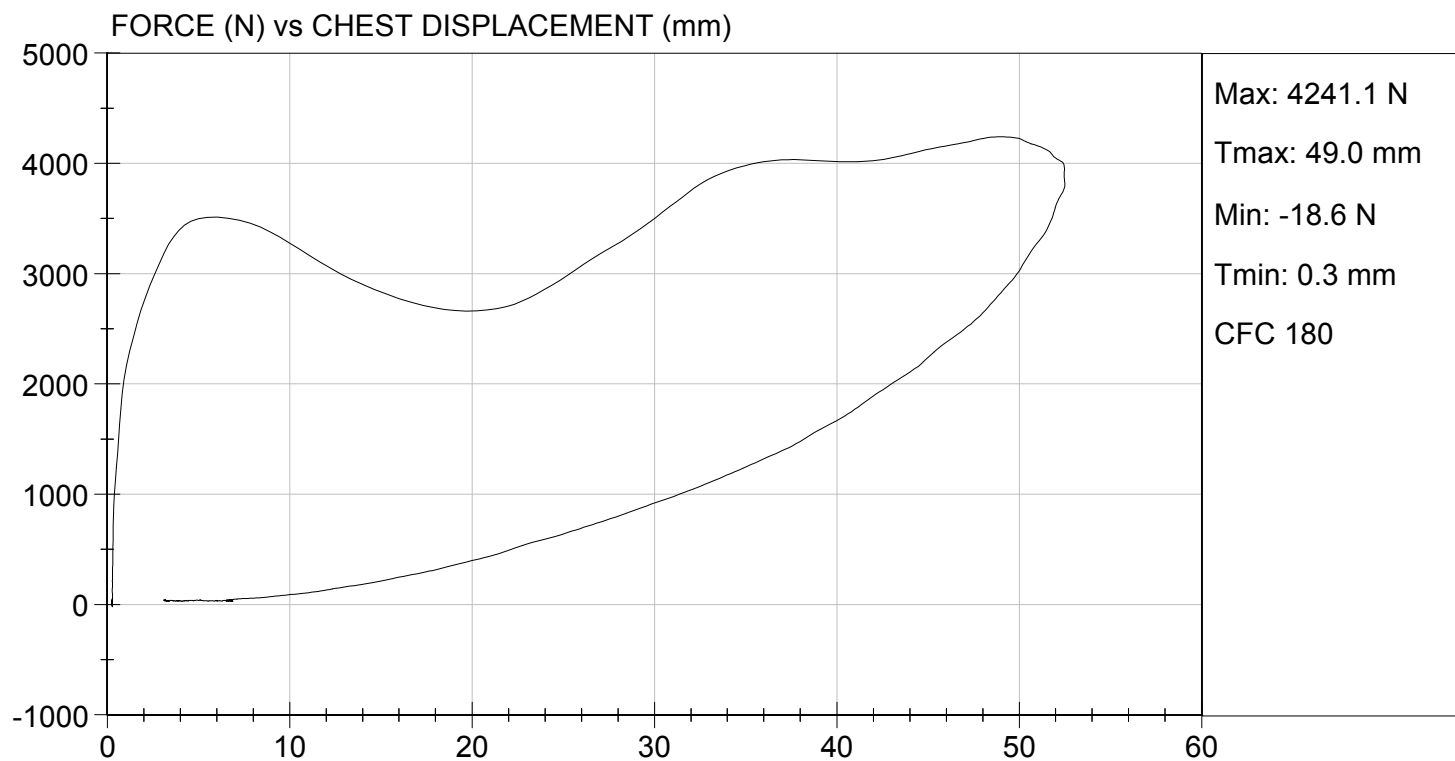
Test Date

Jeff Leonard  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/29/2014  
TEST #: D143404



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X  1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
      X  N/A, ONLY one torso flexion test performed
- X  2. The test fixture conforms to the specifications in Figure 13B.
- X  3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
          With legs below femurs.  
      X  Without legs below femurs.
- X  4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X  6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X  7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X  8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):                     See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 19 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.6 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 331 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 24 deg      |

Maxime Chamberland  
 Signature

09/29/2014  
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D143407

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.0   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 44     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 19     | Pass      |
| Return Angle                 | deg   | +/- 8         | 24     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 331    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.6    | Pass      |
| Overall Result               |       |               |        | Pass      |

Maxime Chamberland  
Laboratory Technician

09/29/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X  1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 X  N/A, ONLY one knee impact test performed
- X  2. The test fixture conforms to the specifications in Figure 14B.
- X  3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X  4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X  6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X  7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X  8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X  9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3522 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Maxime Chamberland

Signature

09/29/2014

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D143406

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 20.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3522   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Maxime Chamberland  
Laboratory Technician

09/29/2014

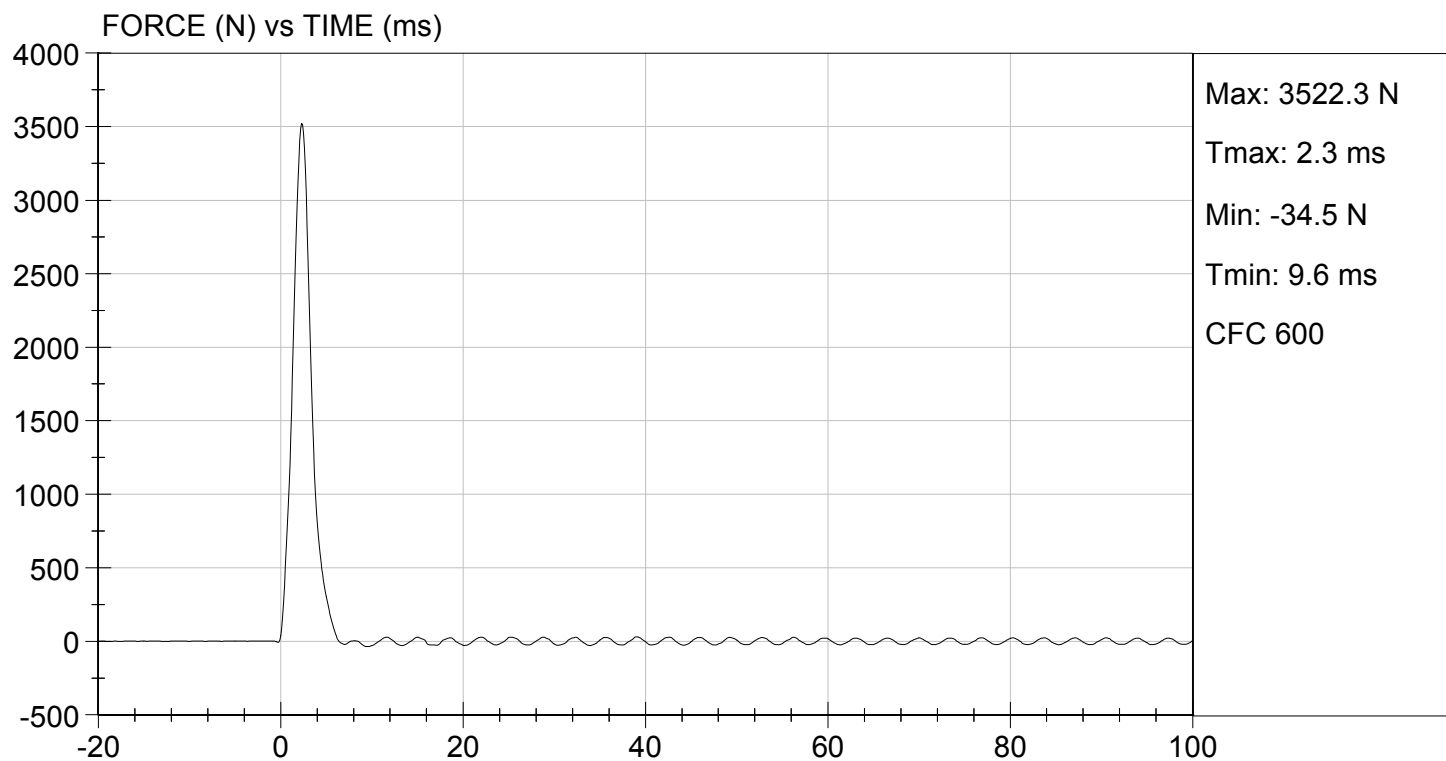
Test Date

Jeff Levan Marsh  
Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.94 ft/s, 2.12 m/s

TEST DATE: 09/29/2014  
TEST #: D143406C



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X  1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 X  N/A, ONLY one knee impact test performed
- X  2. The test fixture conforms to the specifications in Figure 14B.
- X  3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X  4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.1°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- X  5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X  6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X  7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X  8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X  9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.09 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3541 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Maxime Chamberland  
Signature

09/29/2014  
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 125

**Test I.D:** D143405

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 20.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 47     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.09   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3541   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Maxime Chamberland

Laboratory Technician

09/29/2014

Test Date

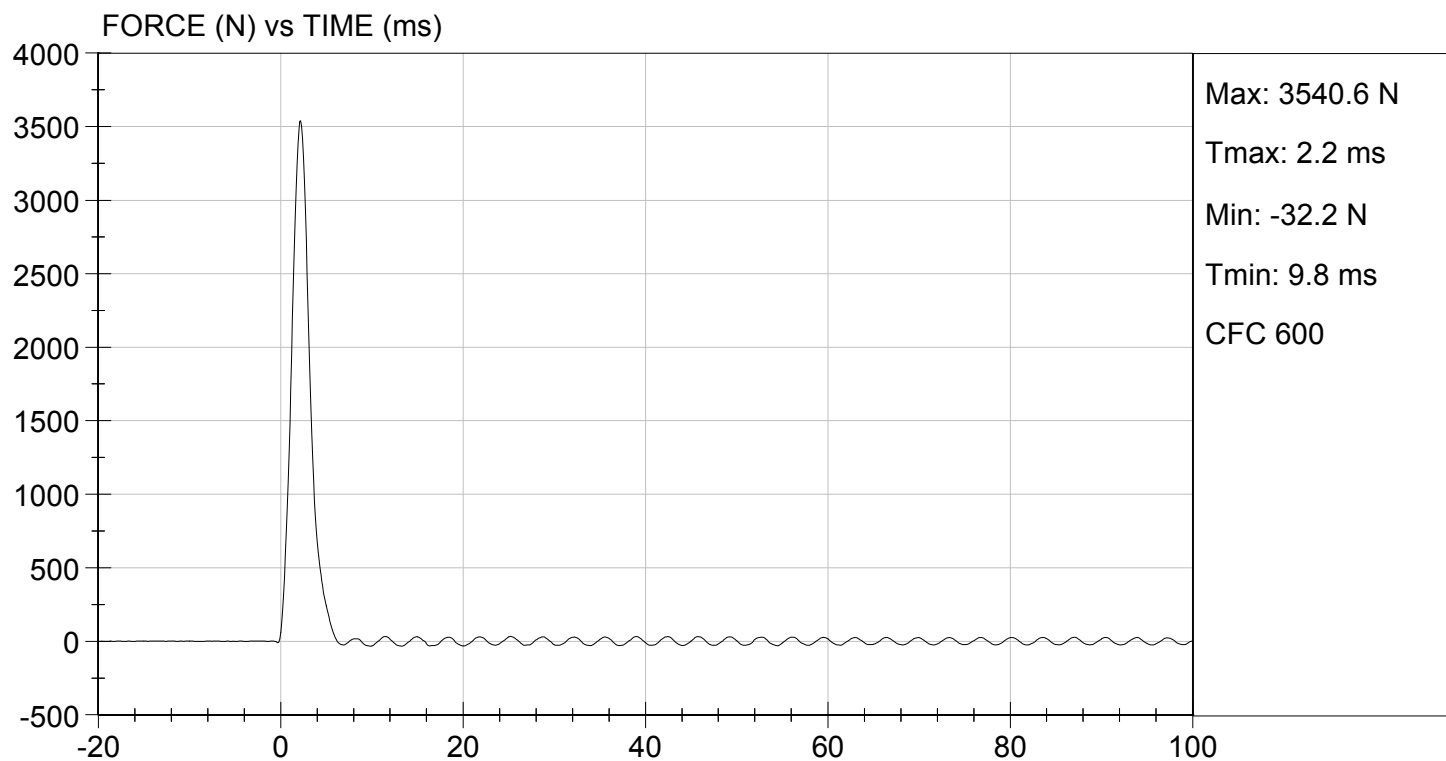
Jeff Leonard

Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.86 ft/s, 2.09 m/s

TEST DATE: 09/29/2014  
TEST #: D143405B



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78268     | 08/08/2014               | 02/08/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79714     | 08/08/2014               | 02/08/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79832     | 08/08/2014               | 02/08/2015               |
| NECK TRANSDUCER                       | Denton       | 1716                | 1673       | 05/27/2014               | 11/27/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79880     | 08/08/2014               | 02/08/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79881     | 08/08/2014               | 02/08/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79882     | 08/08/2014               | 02/08/2015               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 125        | 08/11/2014               | 02/11/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 2024       | 07/23/2014               | 01/23/2015               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 2025       | 07/23/2014               | 01/23/2015               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2015               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/01/2014               |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 125

Test Date: 09/29/2014

Technician: Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damage | OK |
|-----------------------------|--------------------------------------------------------------|----------|--------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |        | X  |
| Head                        | Ballast secure                                               |          |        | X  |
|                             | General appearance                                           |          |        | X  |
| Neck                        | Broken or cracked rubber                                     |          |        | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |        | X  |
|                             | Looseness at the condyle joint                               |          |        | X  |
|                             | Nodding blocks cracked or out of position                    |          |        | X  |
| Spine                       | Broken or cracks in rubber                                   |          |        | X  |
| Ribs                        | Broken or bent ribs                                          |          |        | X  |
|                             | Broken or bent rib supports                                  |          |        | X  |
|                             | Damping material separated or cracked                        |          |        | X  |
|                             | Rubber bumpers in place                                      |          |        | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |        | X  |
|                             | Slider arm riding in track                                   |          |        | X  |
| Transducer leads            | Torn cables                                                  |          |        | X  |
| Accelerometer Mountings     | Head mounting secure                                         |          |        | X  |
|                             | Chest mounting secure                                        |          |        | X  |
| Knees                       | Skin condition                                               |          |        | X  |
|                             | Insert (do not remove)                                       |          |        | X  |
|                             | Casting                                                      |          |        | X  |
| Limbs                       | Normal movement and adjustment                               |          |        | X  |
| Knee Sliders                | Wires intact                                                 |          |        | X  |
|                             | Rubber returned to "at rest" position                        |          |        | X  |
| Pelvis                      | Broken                                                       |          |        | X  |
| Other                       |                                                              |          |        | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

09/29/2014  
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard  
Signature

09/29/2014  
Date

## EXTERNAL DIMENSIONS

| HYBRID III 5 <sup>th</sup> SN #124, PART 572, SUBPART O EXTERNAL DIMENSIONS |                                |                                                                                                                                              |                         |                    |
|-----------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                   | DESCRIPTION                    | DETAILS                                                                                                                                      | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                                           | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                            | 774.7-800.1             | 785.0              |
| B                                                                           | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                       | 431.8-457.2             | 455.1              |
| C                                                                           | H-POINT HEIGHT                 | Reference                                                                                                                                    | 81.3-86.3               | 85.2               |
| D                                                                           | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                    | 144.8-149.8             | 145.6              |
| E                                                                           | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                   | 68.6-83.8               | 83.0               |
| F                                                                           | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                    | 119.4-134.6             | 125.6              |
| G                                                                           | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                           | 243.9-259.1             | 245.9              |
| H                                                                           | HEAD BACK TO BACKLINE          | Back of skull cap skin to seat rear vertical surface (Reference)                                                                             | 43.2-48.2               | 45.0               |
| I                                                                           | SHOULDER TO ELBOW LENGTH       | Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt. | 276.8-297.2             | 296.1              |
| J                                                                           | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                       | 182.8-203.2             | 192.3              |
| K                                                                           | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                         | 520.7-546.1             | 540.2              |
| L                                                                           | POPLITEAL HEIGHT               | Seat surface to the plane of the horizontal plane of the bottom of the feet.                                                                 | 355.6-376.0             | 365.6              |
| M                                                                           | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                             | 393.7-419.1             | 395.8              |
| N                                                                           | BUTTOCK POPLITEAL LENGTH       | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".                               | 414.0-439.4             | 434.5              |

| HYBRID III 5 <sup>th</sup> SN #124, PART 572, SUBPART O EXTERNAL DIMENSIONS, continued |                                                           |                                                         |                         |                    |
|----------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                              | DESCRIPTION                                               | DETAILS                                                 | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O                                                                                      | CHEST DEPTH WITHOUT JACKET                                | Measured 304.8 ± 5.1 mm above seat surface              | 175.3-190.5             | 176.0              |
| P                                                                                      | FOOT LENGTH                                               | Tip of toe to rear of heel                              | 218.5-233.7             | 219.4              |
| Q                                                                                      | STANDING HEIGHT                                           | (THEORETICAL)                                           | 1501.1                  | N/A                |
| R                                                                                      | BUTTOCK TO KNEE PIVOT LENGTH                              | The rear surface of the buttocks to the knee pivot bolt | 457.2-482.6             | 481.0              |
| S                                                                                      | HEAD BREADTH                                              | The widest part of the head                             | 137.1-147.3             | 138.6              |
| T                                                                                      | HEAD DEPTH                                                | Back of the head to the forehead                        | 177.8-188.0             | 186.2              |
| U                                                                                      | HIP BREADTH                                               | The widest part of the hip                              | 299.7-314.9             | 310.7              |
| V                                                                                      | SHOULDER BREADTH                                          | Outside edges of right and left shoulder clevises       | 350.5-365.7             | 354.9              |
| W                                                                                      | FOOT BREADTH                                              | The widest part of the foot                             | 78.8-94.0               | 82.0               |
| X                                                                                      | HEAD CIRCUMFERENCE                                        | Measured at the point as in dim. "T"                    | 528.3-548.7             | 547.1              |
| Y                                                                                      | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                   | Measured 345.4 ± 12.7 mm above seat surface             | 850.9-881.3             | 881.0              |
| Z                                                                                      | WAIST CIRCUMFERENCE                                       | Measured 165.1 ± 5.1 mm above seat surface              | 759.5-789.9             | 786.3              |
| AA                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE | Reference                                               | 332.7-358.1             | 357.4              |
| BB                                                                                     | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE | Reference                                               | 160.1-170.2             | 169.8              |

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: Joseph Radke

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

X 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
    X N/A, ONLY one head drop performed

X 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))

X 3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

X 4. Accelerometers and their respective mounts are smooth and clean.

X 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))

X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))

Record the maximum temperature: 21.4°C

Record the minimum temperature: 21.0°C

Record the maximum humidity: 48%

Record the minimum humidity: 45%

X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No Damage

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 264 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -7.9 g |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Joseph Radtke  
Signature

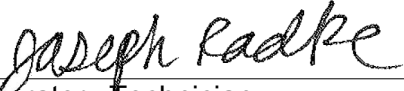
07/30/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

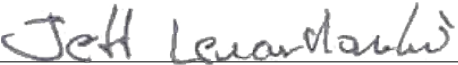
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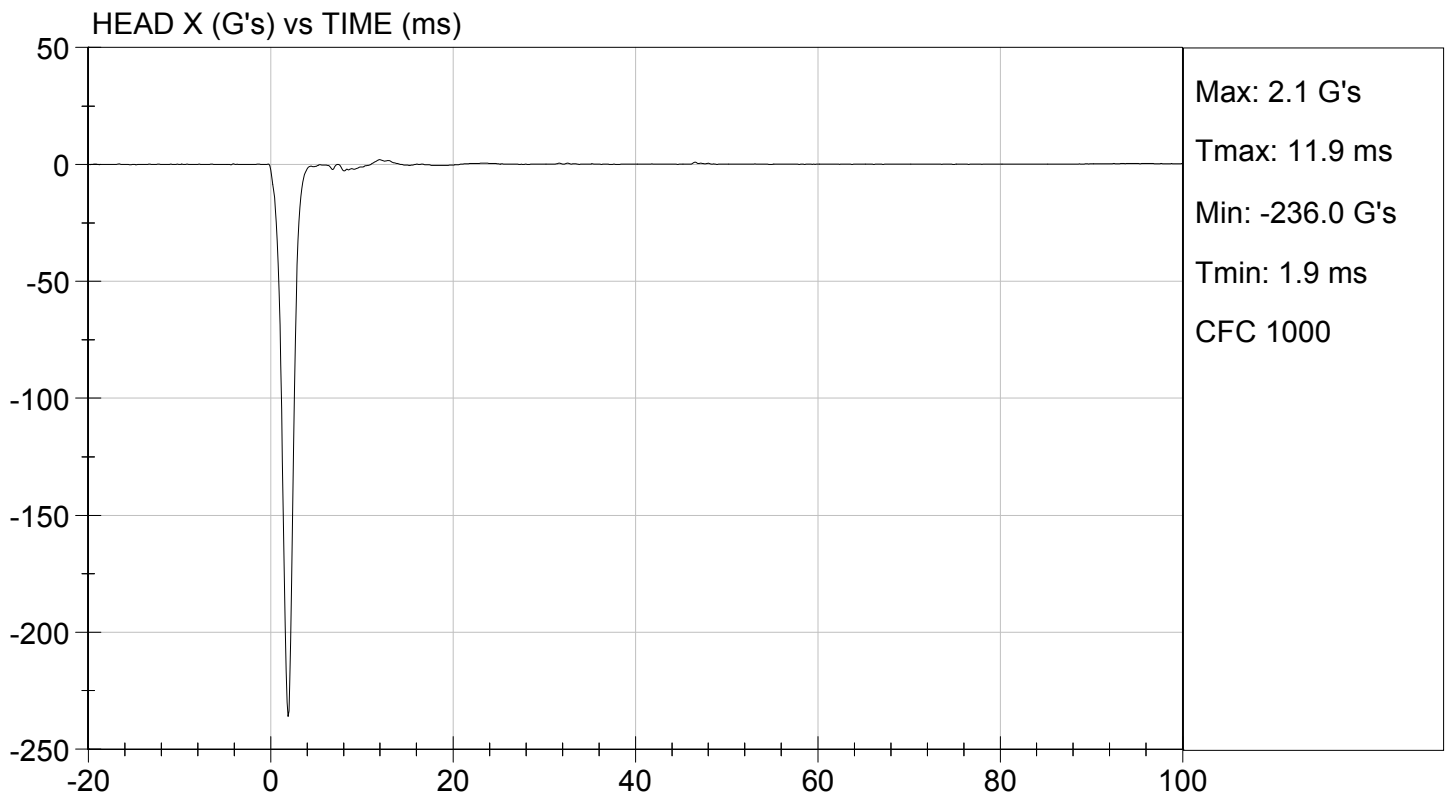
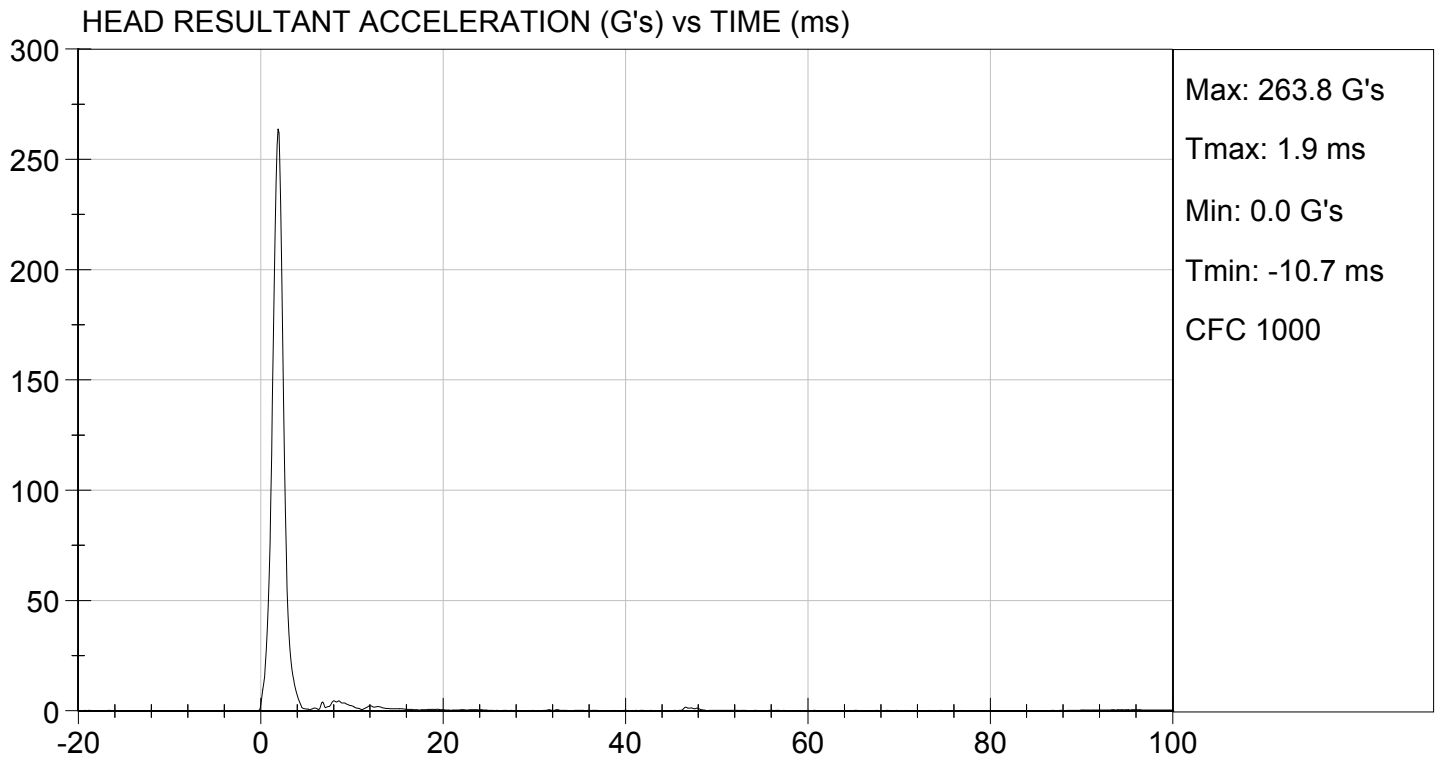
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 48     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 264    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -7.9   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

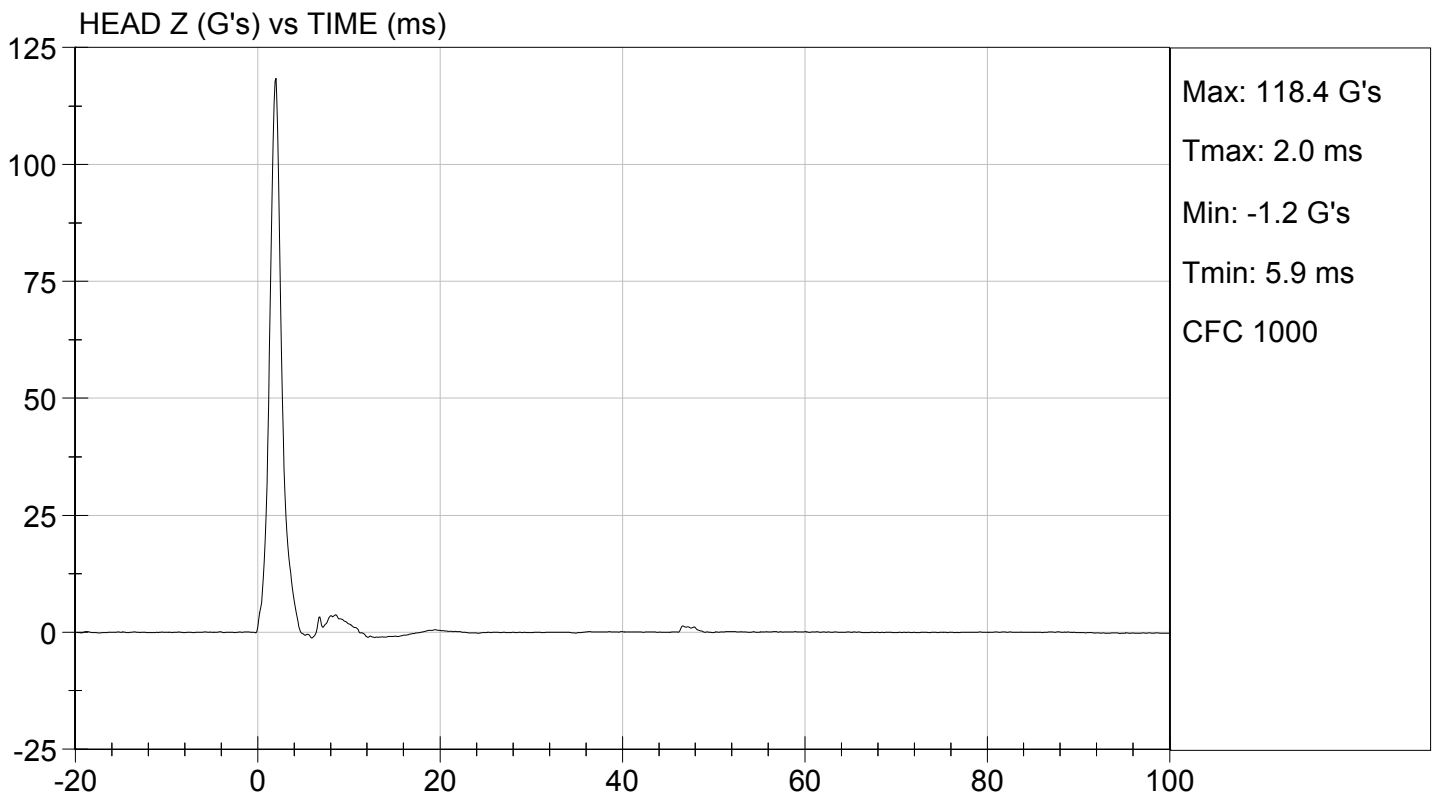
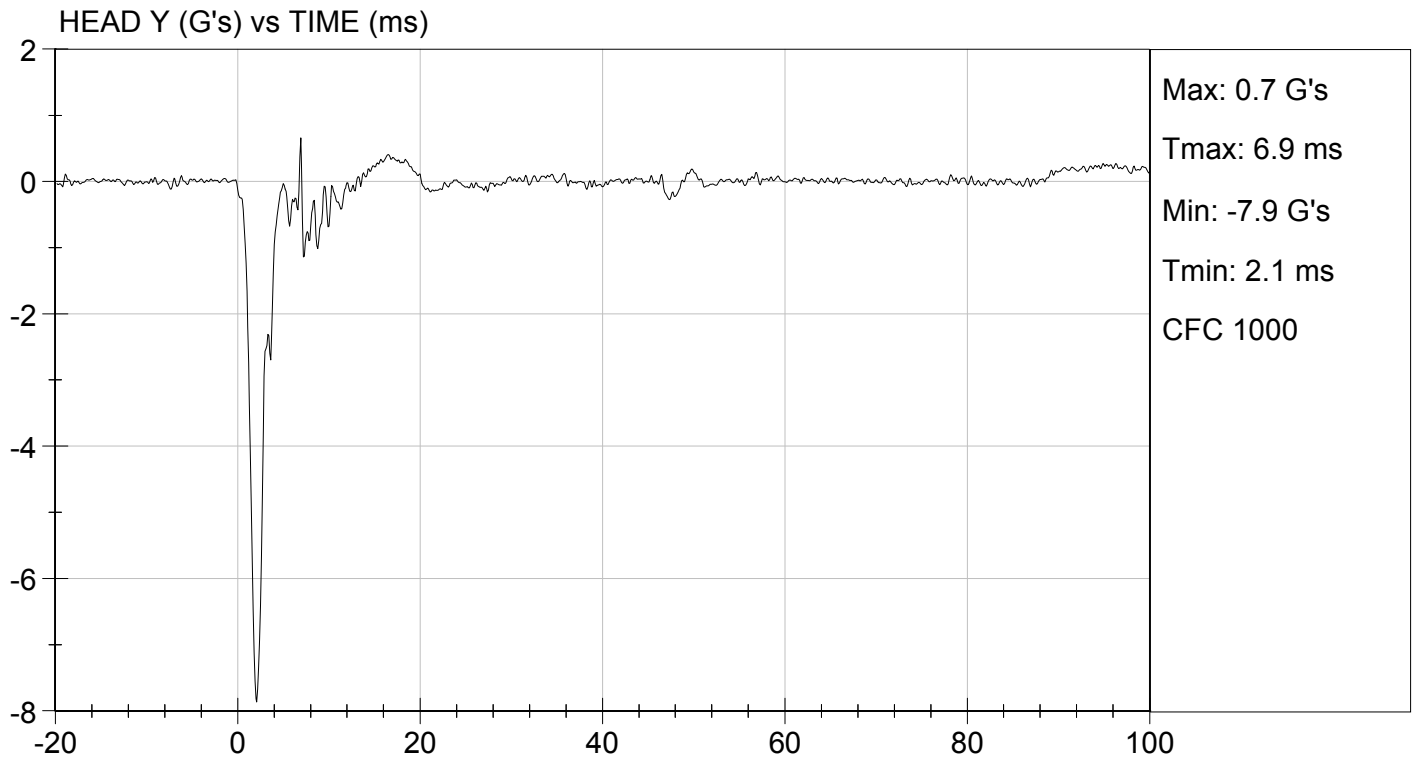
  
Laboratory Technician

07/30/2014

Test Date

  
Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- X 1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X   7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X   8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X   9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X   10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X   11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X   12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X   13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                       | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 6.89 m/s $\leq$ speed $\leq$ 7.13 m/s                                                                               | 7.06 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                                | 2.4 m/s            |
|                                                  | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                                | 4.5 m/s            |
|                                                  | @ 30 ms | 5.8 m/s $\leq \Delta V \leq$ 7.0 m/s                                                                                | 6.4 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range<br>77° $\leq$ angle $\leq$ 91° | 71 Nm @ 81 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>80 ms $\leq$ time $\leq$ 100 ms                                                           | 84 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X   14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

David Schoedel  
Signature

07/30/2014  
Date

## MGA RESEARCH CORPORATION

## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

ATD Serial No: 124

Test I.D: D142712

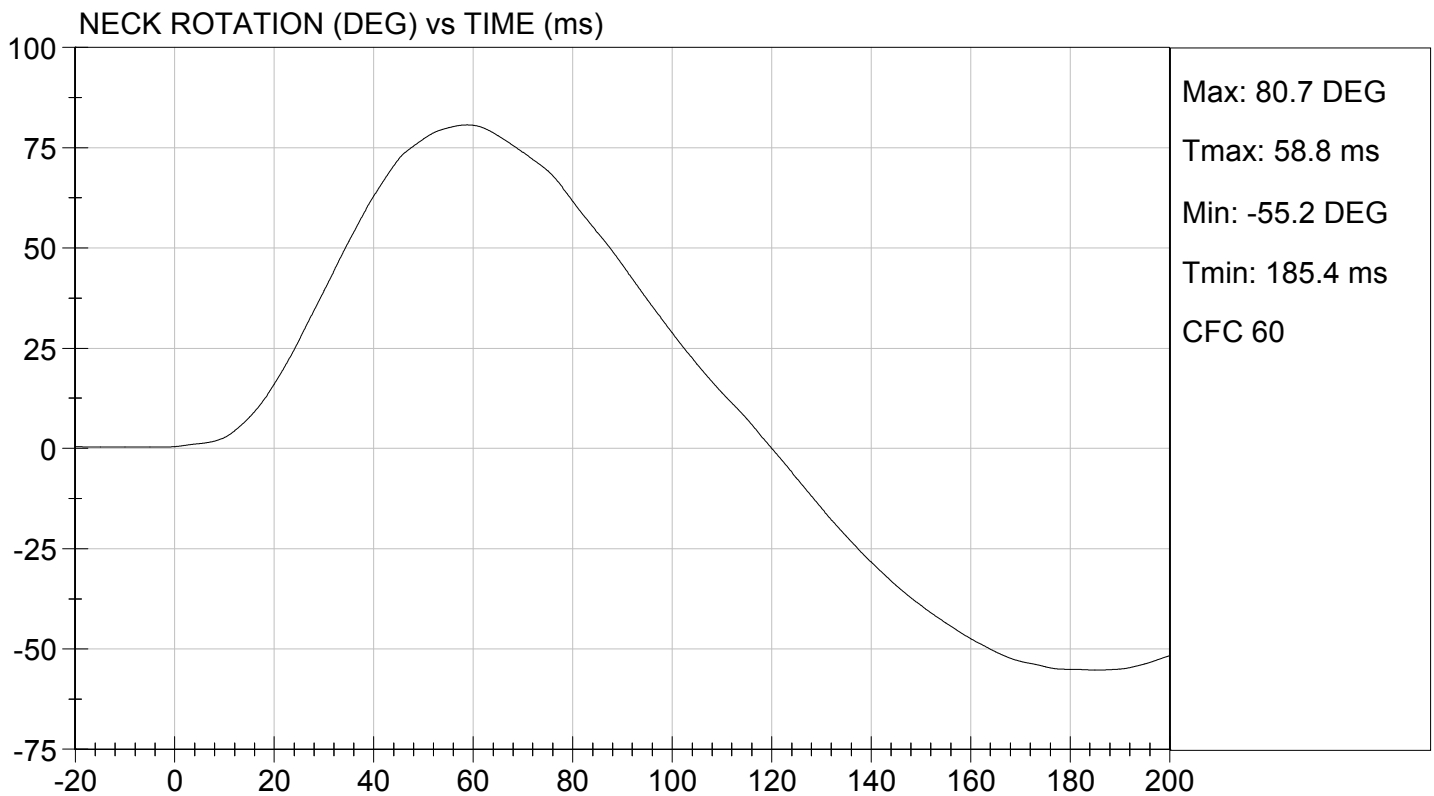
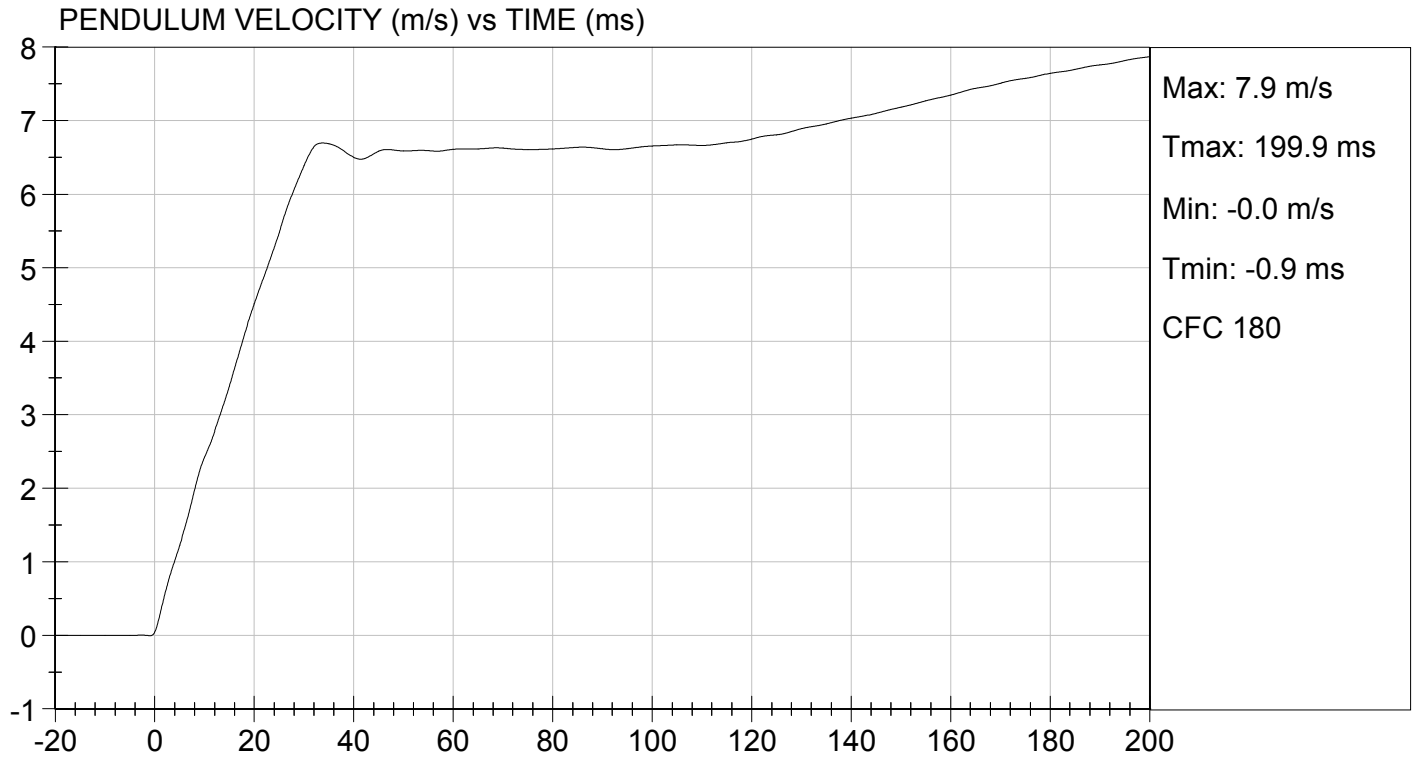
| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 7.06   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.4    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.5    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 6.4    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 81     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 71     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 84     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

*David Schoedel*  
Laboratory Technician

07/30/2014

Test Date

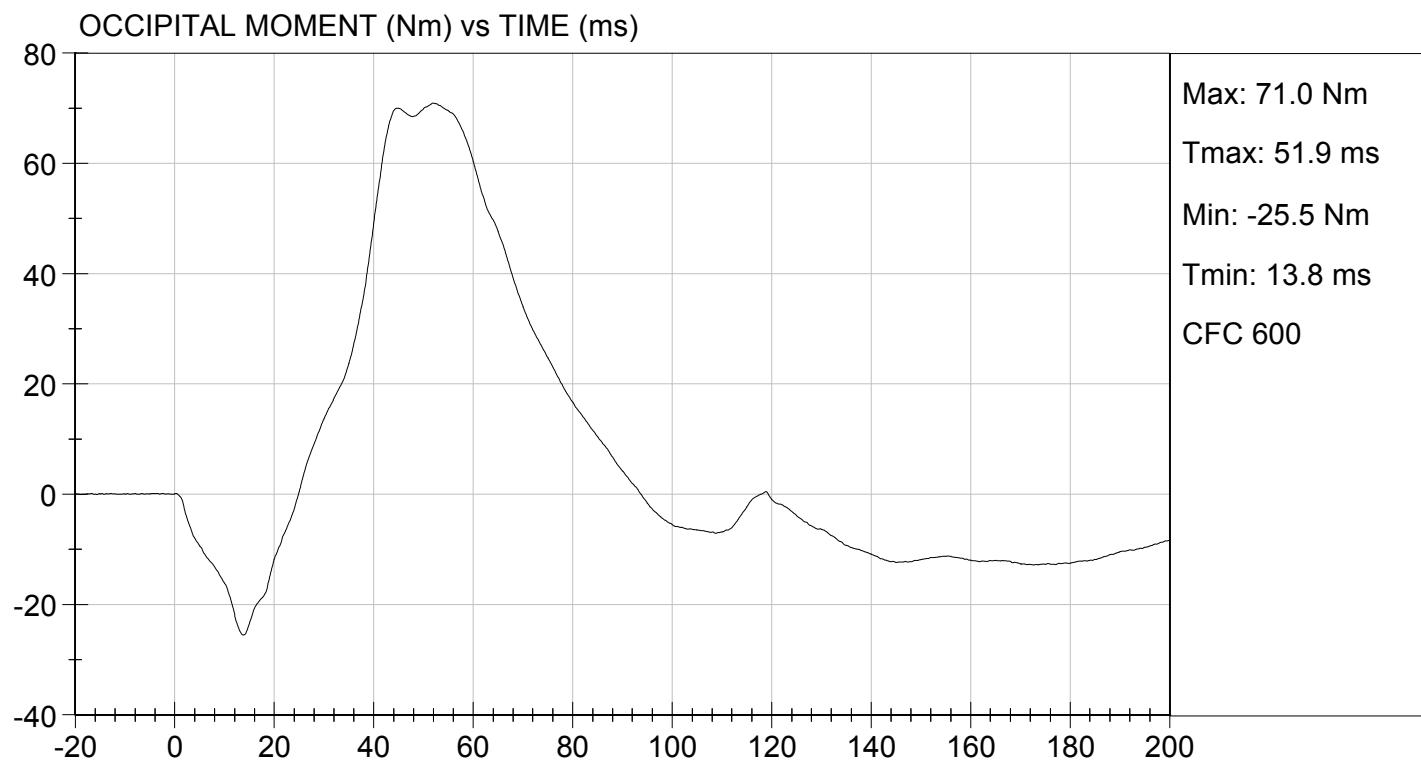
*Jeff Leonard*  
Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 07/30/2014  
TEST #: D142712



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: David Schoedel

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last extension test. (572.137(q))  
☒ N/A, ONLY one neck test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- ☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- |                              |                  |
|------------------------------|------------------|
| Record findings and actions: | <u>No damage</u> |
|------------------------------|------------------|
- ☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- |                              |                                                       |
|------------------------------|-------------------------------------------------------|
| Record findings and actions: | <u>No Deterioration; Hardness: Front 89; Back 90.</u> |
|------------------------------|-------------------------------------------------------|
- ☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.17 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.7 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.6 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.2 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -58 Nm @ 107 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 100 ms               |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

07/30/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

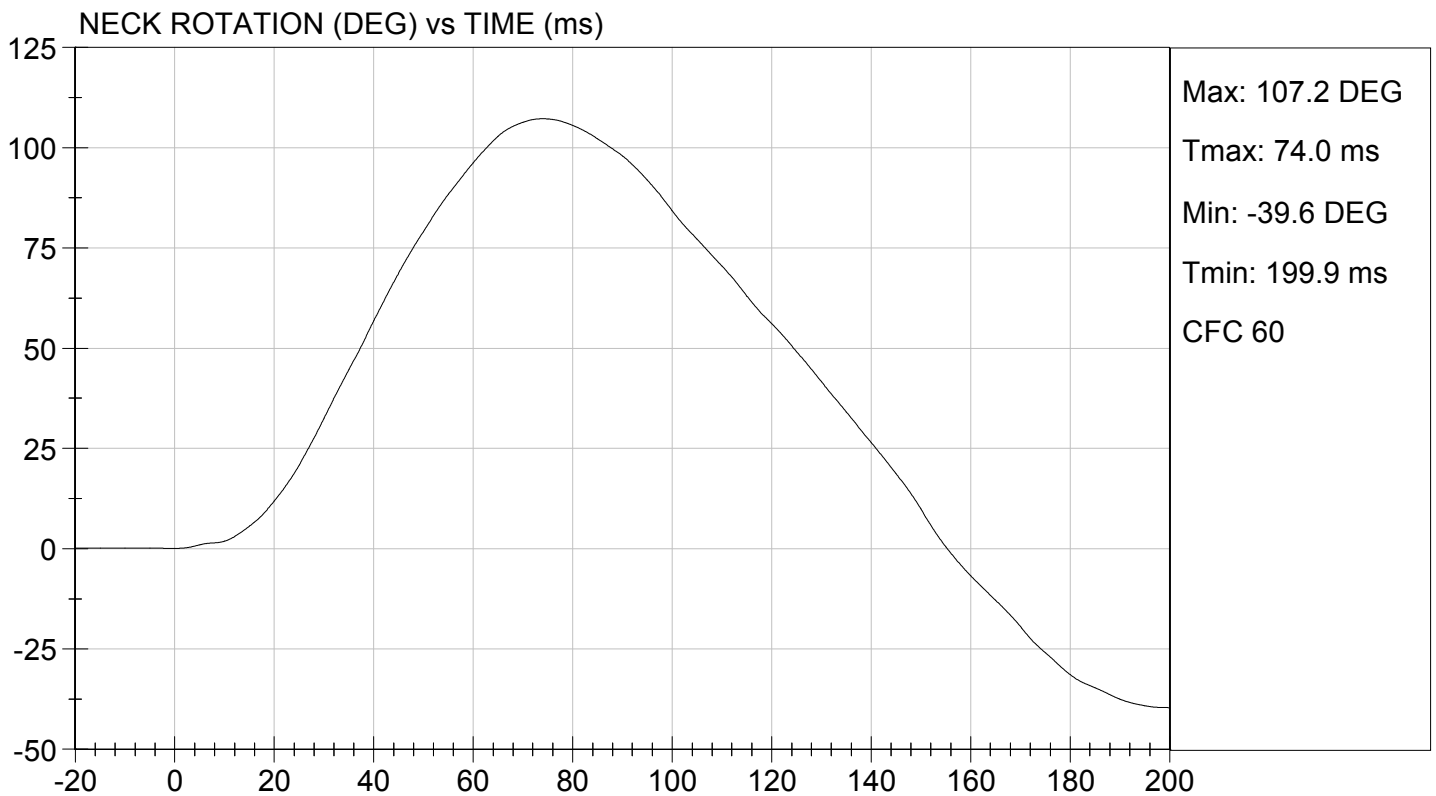
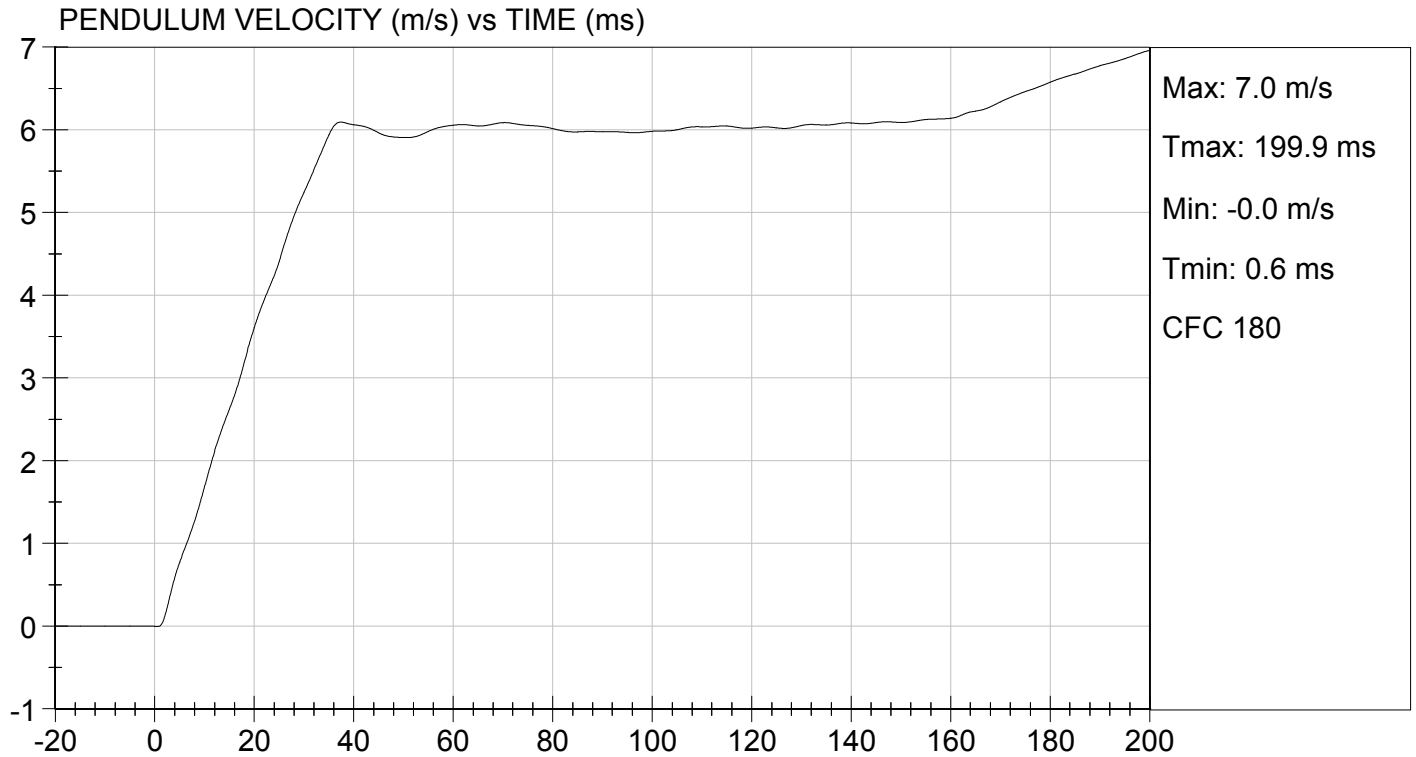
**Test I.D:** D142713

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.0   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.17   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.7    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.6    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.2    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 107    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -58    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 100    | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

07/30/2014  
Test Date

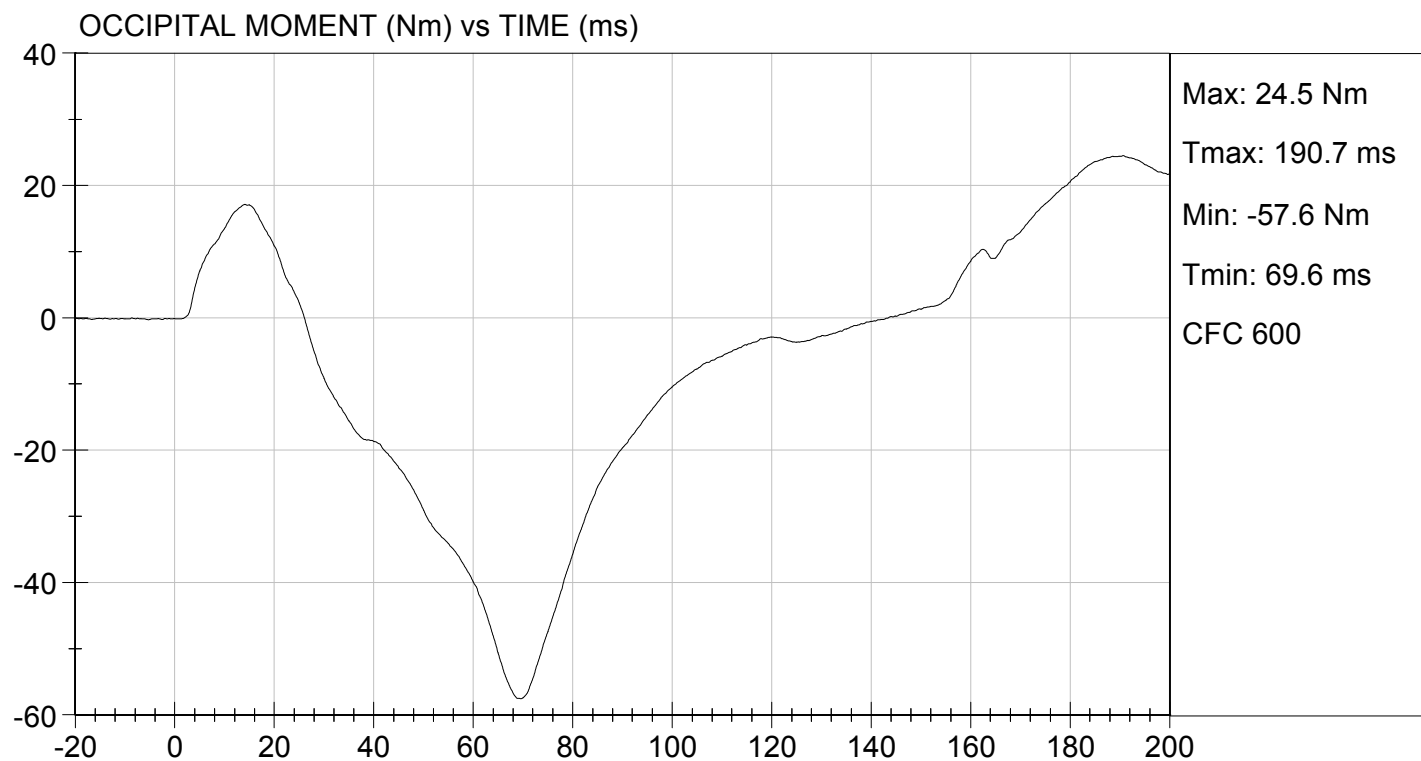
Jeff Leonard  
Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 20.25 ft/s, 6.17 m/s

TEST DATE: 07/30/2014  
TEST #: D142713



**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 124

Test Date: 07/31/2014

Technician: Joseph Radke

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11B.
- ☒ 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- ☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |

- ☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

☒ - No Damage

☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

☐ - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

- X   16. Complete the following table:  
Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                                                  | Result   |
|---------------------------------------------------------|----------------------------------------------------------------|----------|
| Test Probe Speed                                        | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.60 m/s |
| Chest Compression                                       | $50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$ | 55 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | $3900\text{N} \leq \text{peak force} \leq 4400\text{N}$        | 4269 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq 4600 \text{ N}$                               | 4178 N   |
| Internal Hysteresis***                                  | $69\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.134(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

- X   17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Joseph Radtke  
Signature

07/31/2014  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D142714

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.4   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.60   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 55     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4269   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4178   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

Joseph Radke  
Laboratory Technician

07/31/2014

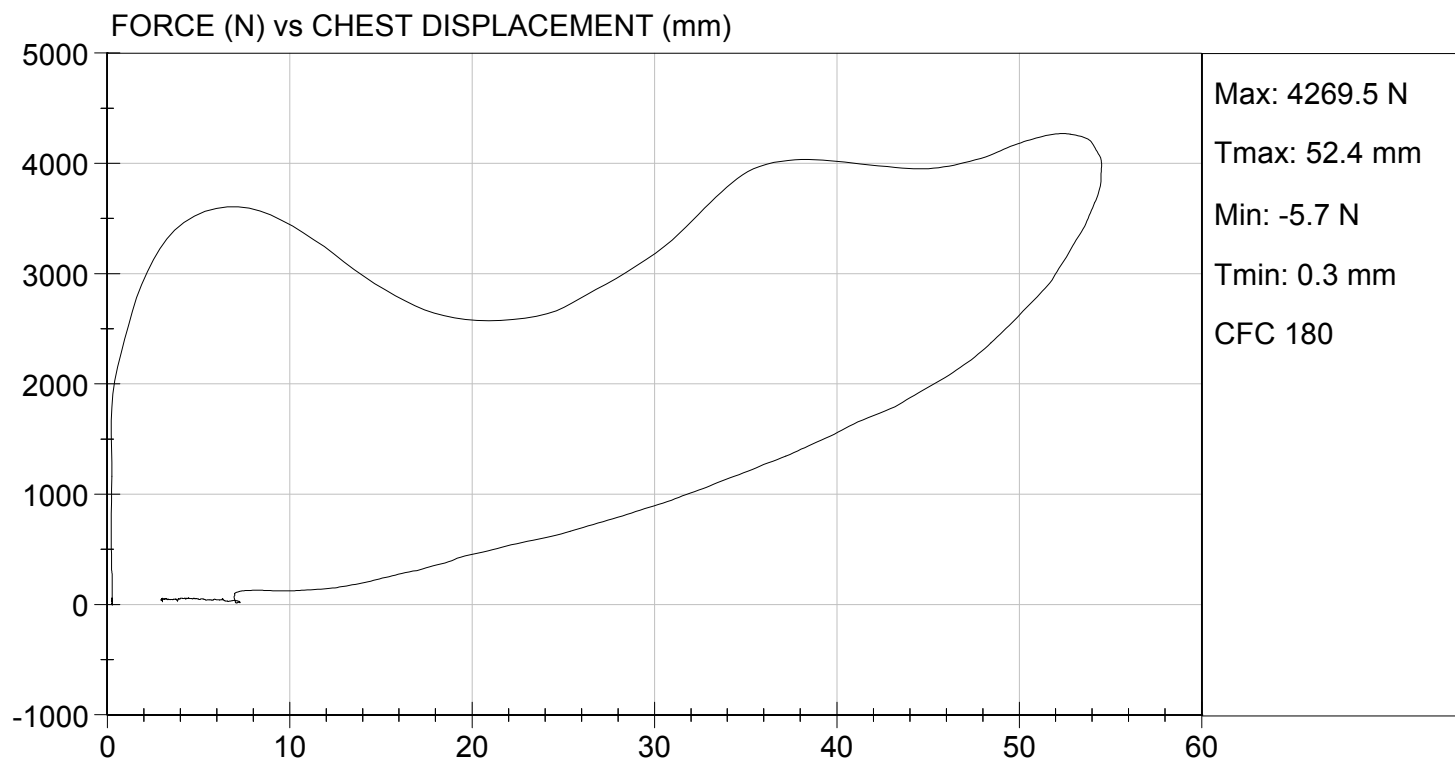
Test Date

Jeff Leonard  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 07/31/2014  
TEST #: D142714



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: Joseph Radke

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
    X N/A, ONLY one torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 13B.
- X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
     With legs below femurs.  
    X Without legs below femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):                     See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 17 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.9 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 350 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 18 deg      |

Joseph Radtke  
 Signature

07/30/2014  
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D142717

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 48     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 17     | Pass      |
| Return Angle                 | deg   | +/- 8         | 18     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 350    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.9    | Pass      |
| Overall Result               |       |               |        | Pass      |

Joseph Radke  
Laboratory Technician

07/30/2014  
Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: David Schoedel

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.13 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3673 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

David Schoedel  
Signature

07/30/2014  
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D142716

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 47     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.13   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3673   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

*David Schoedel*

Laboratory Technician

07/30/2014

Test Date

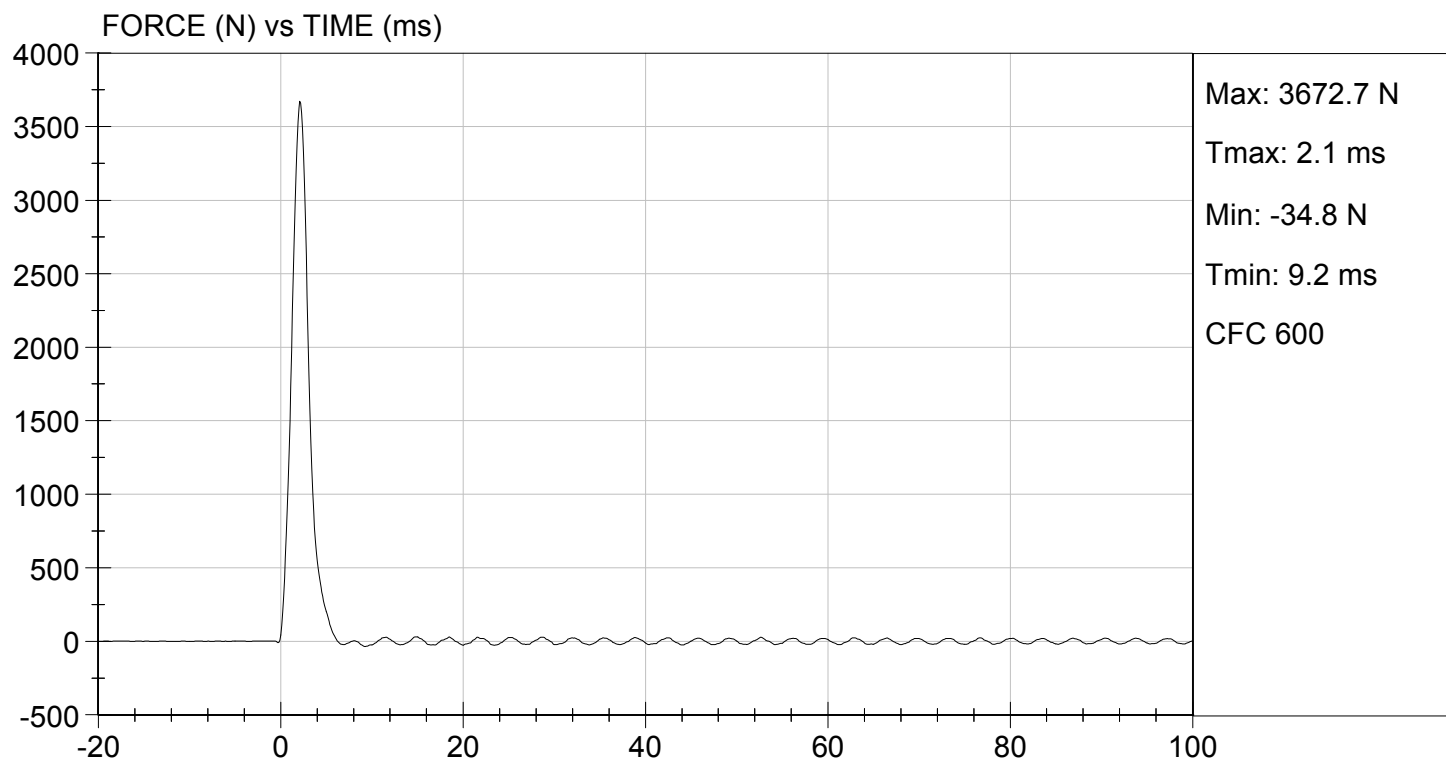
*Jeff Leonard*

Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 07/30/2014  
TEST #: D142716



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 07/30/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>45%</u>    |

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.136(c)(6))

  X   11. Complete the following table:  
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.13 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3853 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

David Schoedel  
Signature

07/30/2014  
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D142715

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 47     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.13   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3853   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

David Schoedel

Laboratory Technician

07/30/2014

Test Date

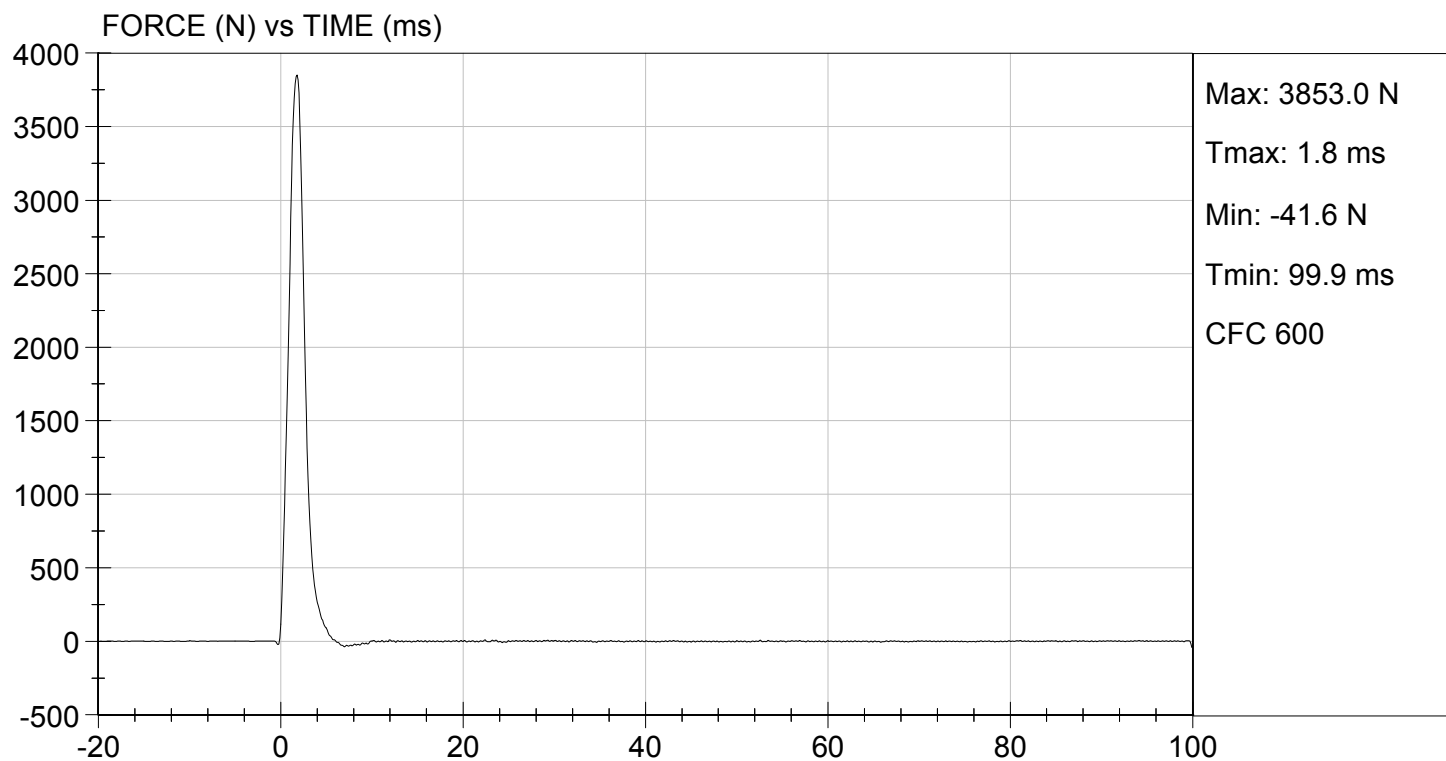
Jeff Leonard

Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 07/30/2014  
TEST #: D142715



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78702     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78777     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78781     | 07/02/2014               | 01/02/2015               |
| NECK TRANSDUCER                       | Denton       | 1716                | 2320       | 05/30/2014               | 11/30/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79695     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79696     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79740     | 07/02/2014               | 01/02/2015               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 124        | 07/08/2014               | 01/08/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 1361       | 04/23/2014               | 10/23/2014               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 1362       | 04/23/2014               | 10/23/2014               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AH467      | 02/20/2014               | 8/20/2014                |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/1/2014                |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B3**  
**HEAD DROP TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X  1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- X  3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X  4. Accelerometers and their respective mounts are smooth and clean.
- X  5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- X  7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))  
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 300 \text{ g}$        | 294 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 1.6 g  |

- X 17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Jessica Hall  
Signature

09/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

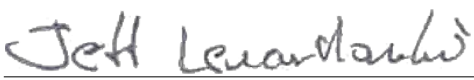
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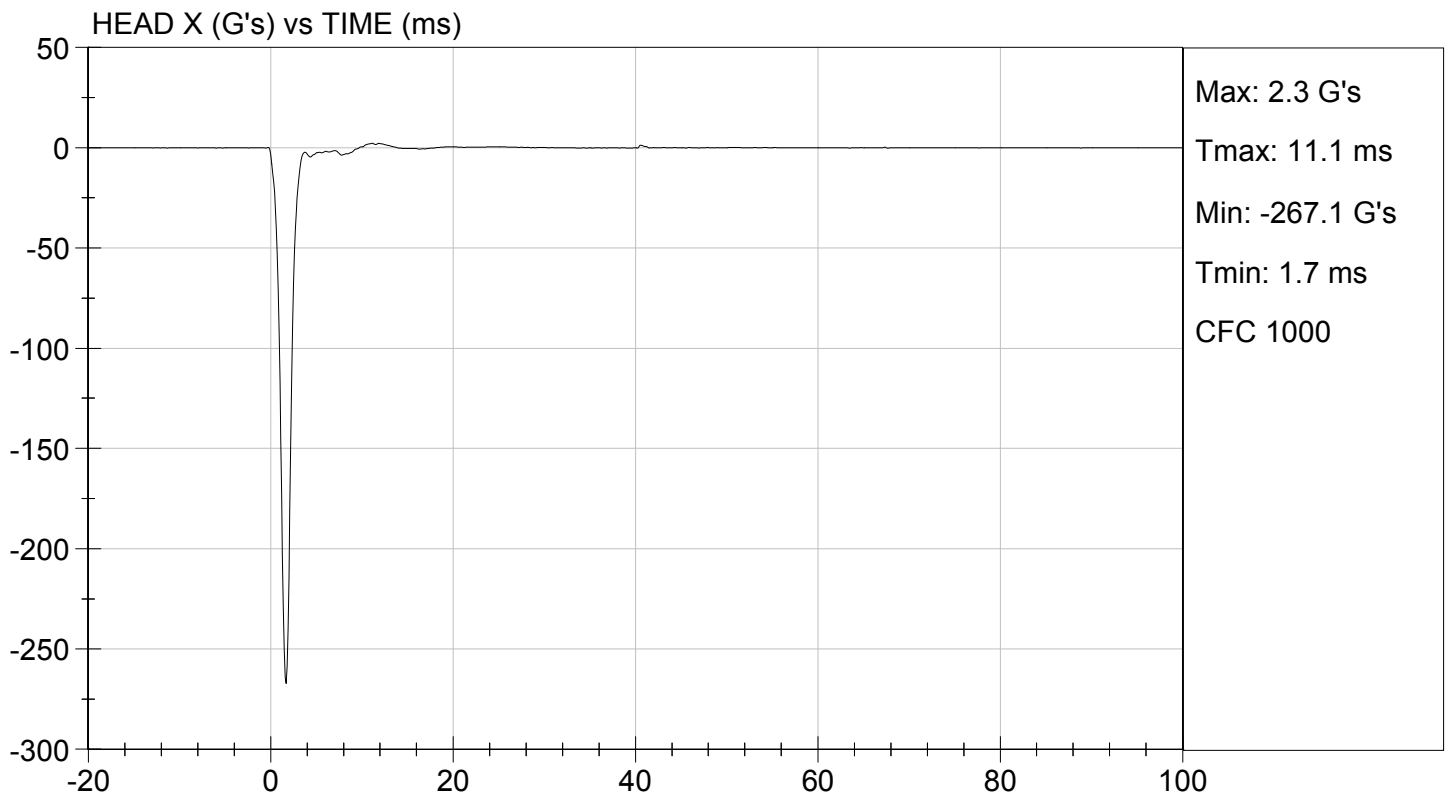
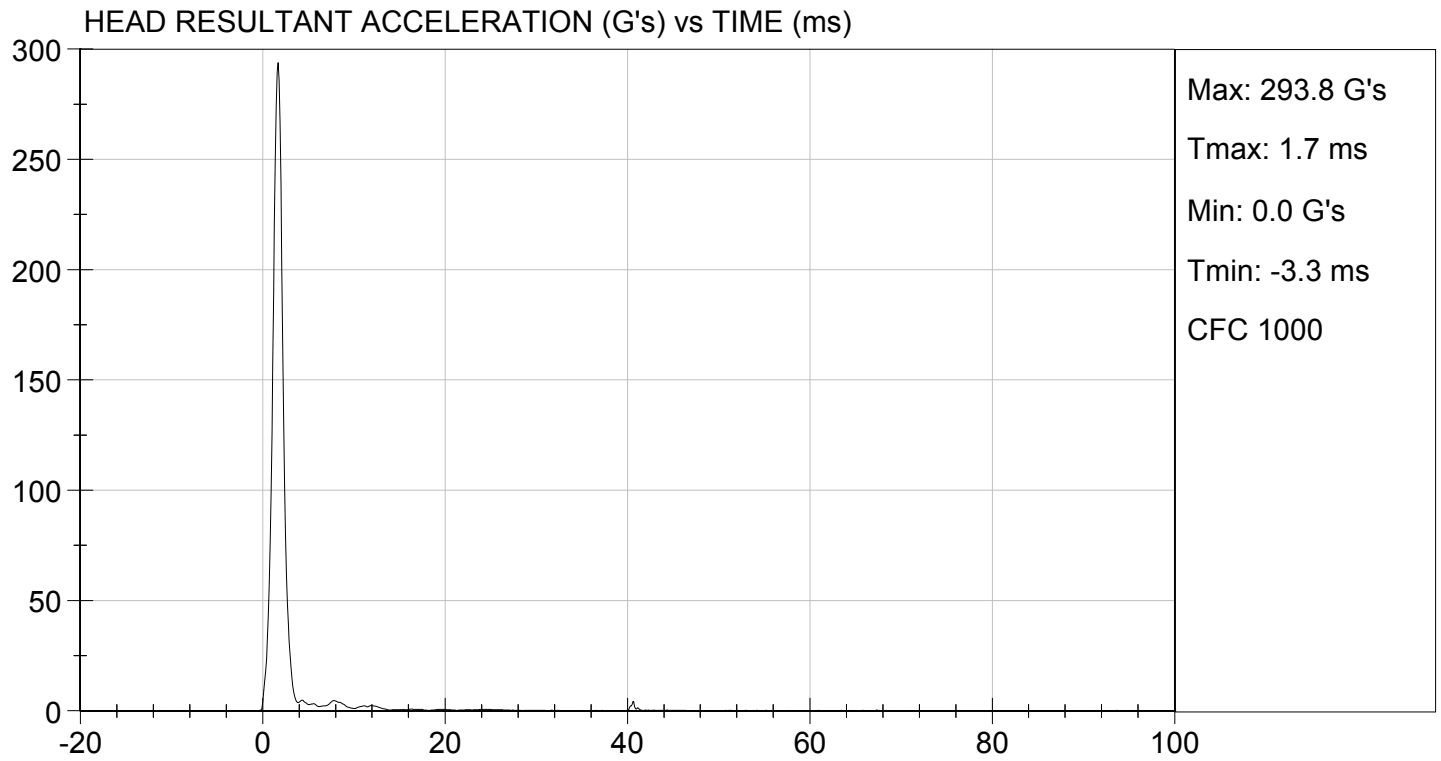
| Tested Parameter             | Units | Specification      | Result               | Pass/Fail |
|------------------------------|-------|--------------------|----------------------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.7                 | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 51                   | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 300         | 294                  | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 1.6                  | Pass      |
| Unimodal                     | N/A   | Yes                | Yes                  | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes                  | Pass      |
|                              |       |                    | Overall Test Results | Pass      |

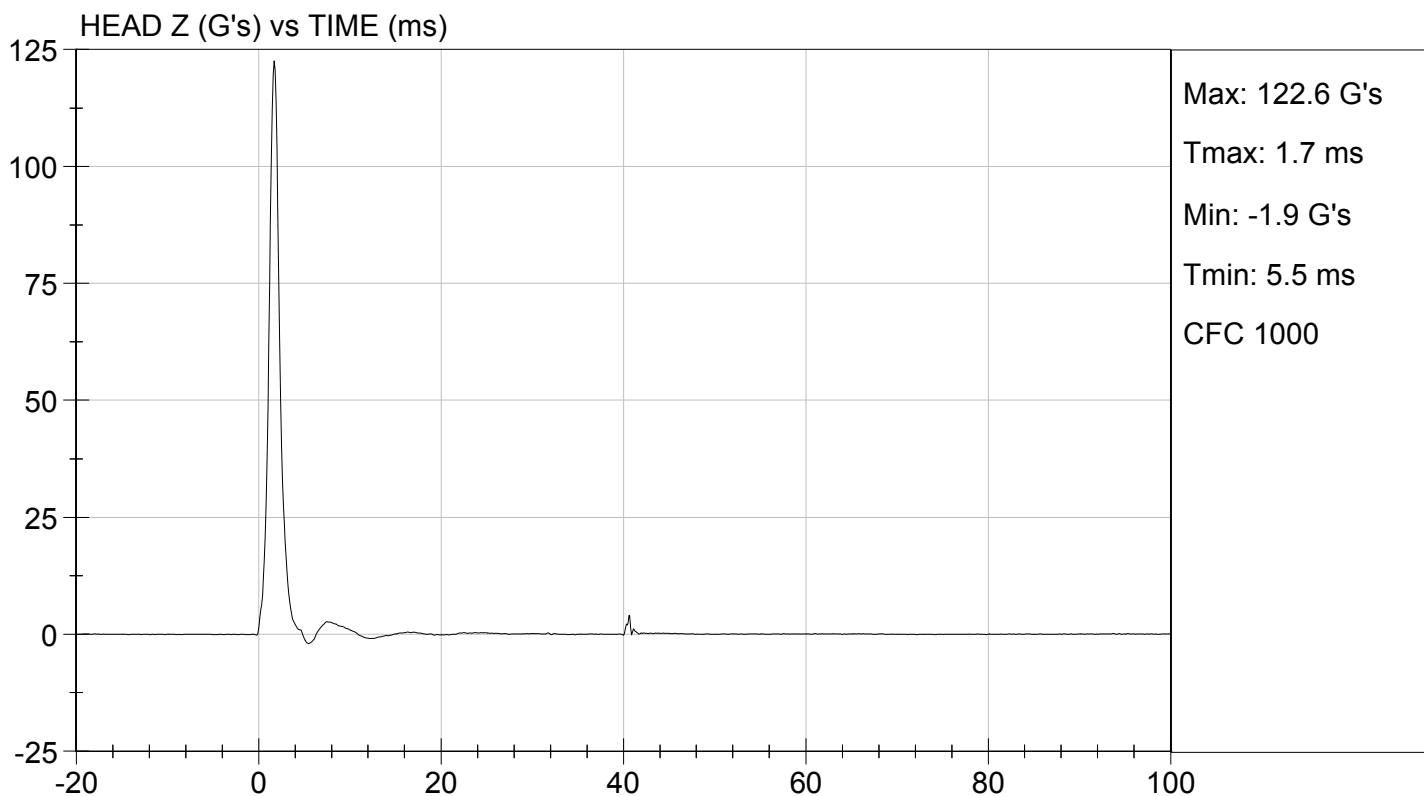
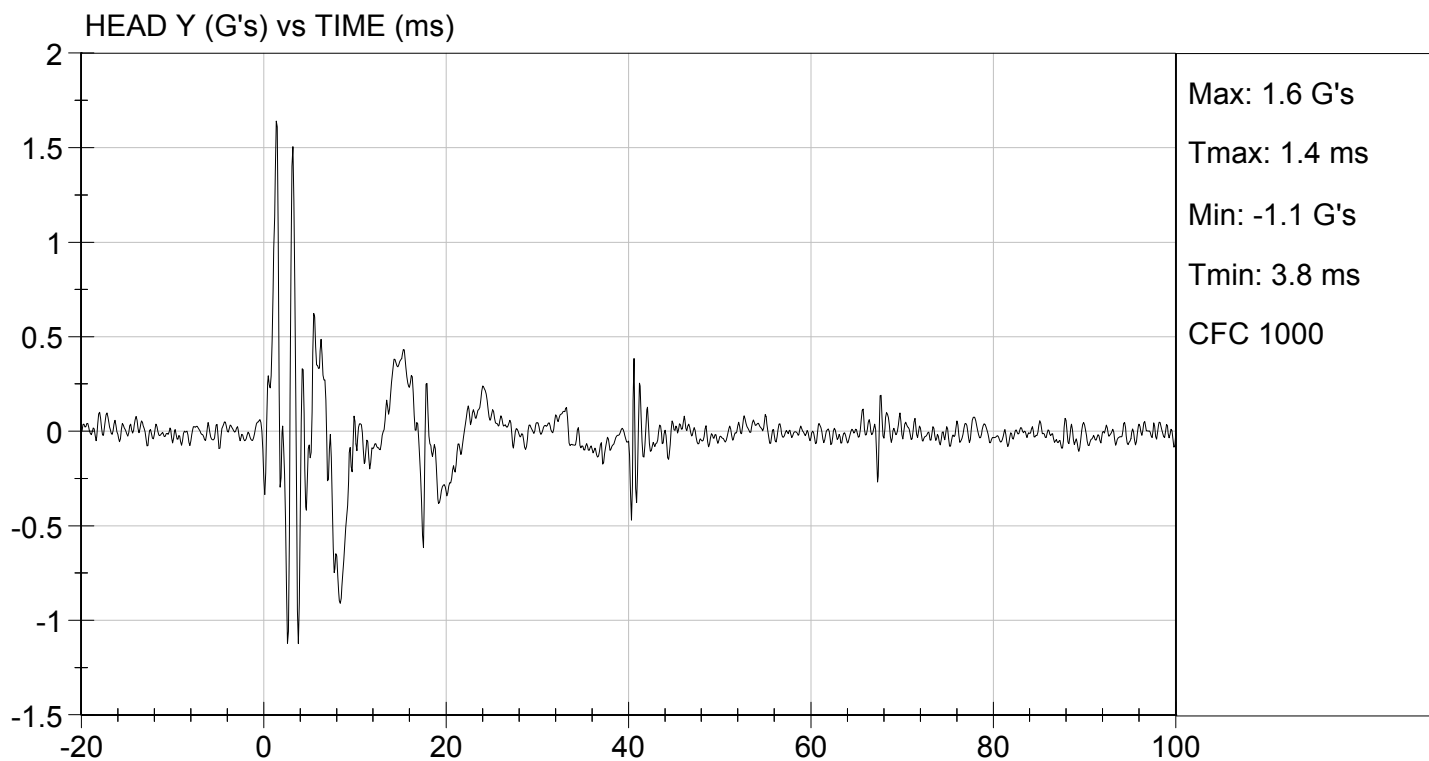
  
Laboratory Technician

09/09/2014

Test Date

  
Approved By





**DATA SHEET B4**  
**NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

       Pre test calibration  
  X   Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- X   1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
         X   N/A, ONLY one neck test performed
- X   2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X   3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X   4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X   5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X   6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:

Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                       | Results            |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 6.89 m/s $\leq$ speed $\leq$ 7.13 m/s                                                                               | 6.96 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 2.1 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                                | 2.3 m/s            |
|                                                  | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                                | 4.6 m/s            |
|                                                  | @ 30 ms | 5.8 m/s $\leq \Delta V \leq$ 7.0 m/s                                                                                | 6.4 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range<br>77° $\leq$ angle $\leq$ 91° | 70 Nm @ 82 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 10 Nm<br>80 ms $\leq$ time $\leq$ 100 ms                                                           | 88 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follows this sheet.

Jessica Hall  
Signature

09/09/2014  
Date

## MGA RESEARCH CORPORATION

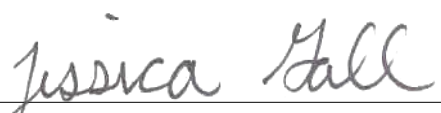
## NECK FLEXION TEST

## HYBRID III 5TH PERCENTILE

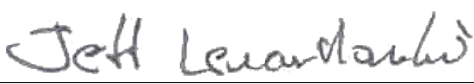
ATD Serial No: 124

Test I.D: D143072

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.5   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 49     | Pass      |
| Pendulum Speed                                    |       | m/s   | 6.89 to 7.13  | 6.96   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 2.1 to 2.5    | 2.3    | Pass      |
|                                                   | 20 ms | m/s   | 4.0 to 5.0    | 4.6    | Pass      |
|                                                   | 30 ms | m/s   | 5.8 to 7.0    | 6.4    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 77 to 91      | 82     | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | 69 to 83      | 70     | Pass      |
| Positive Moment Time Curve Decay to 10 Nm         |       | ms    | 80 to 100     | 88     | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

  
 Laboratory Technician

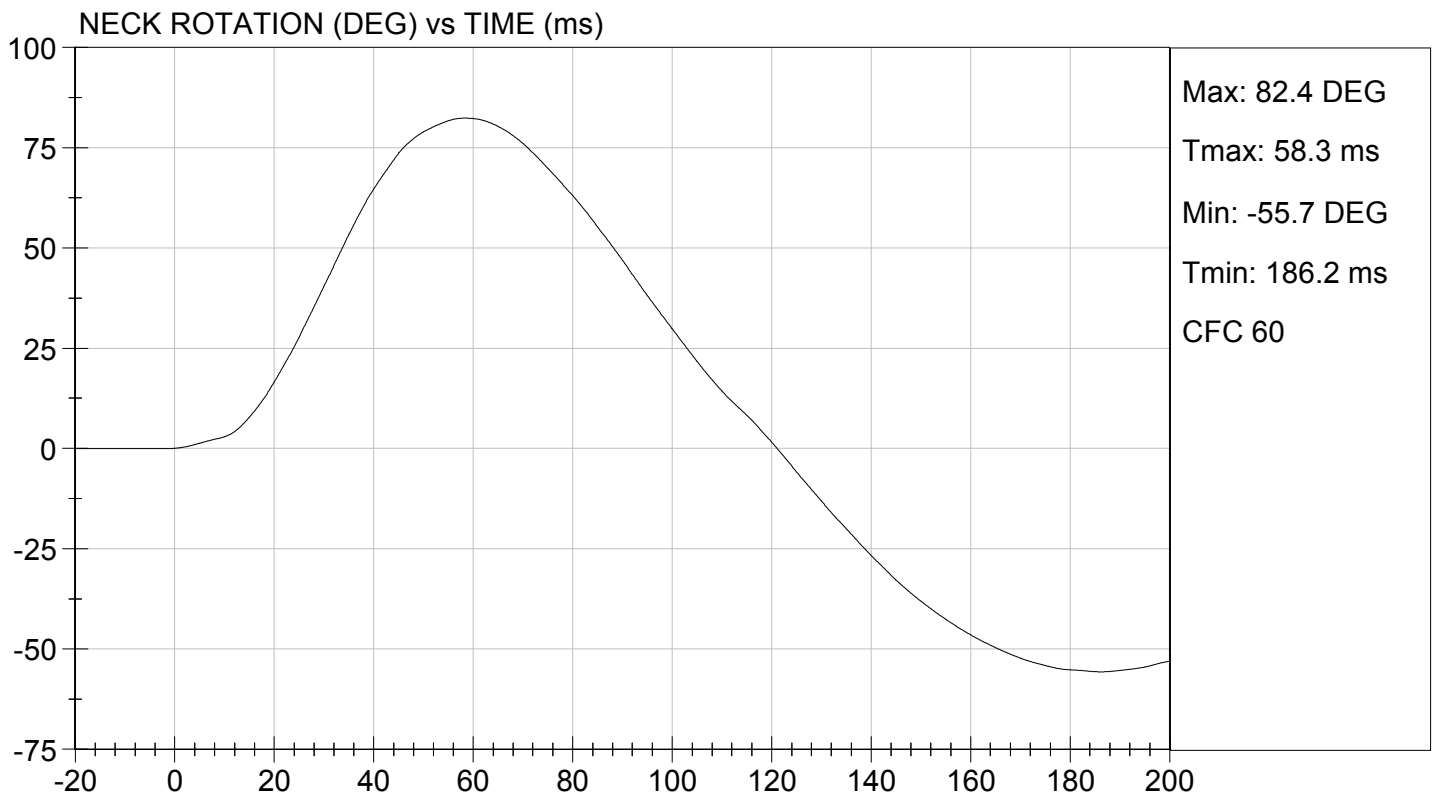
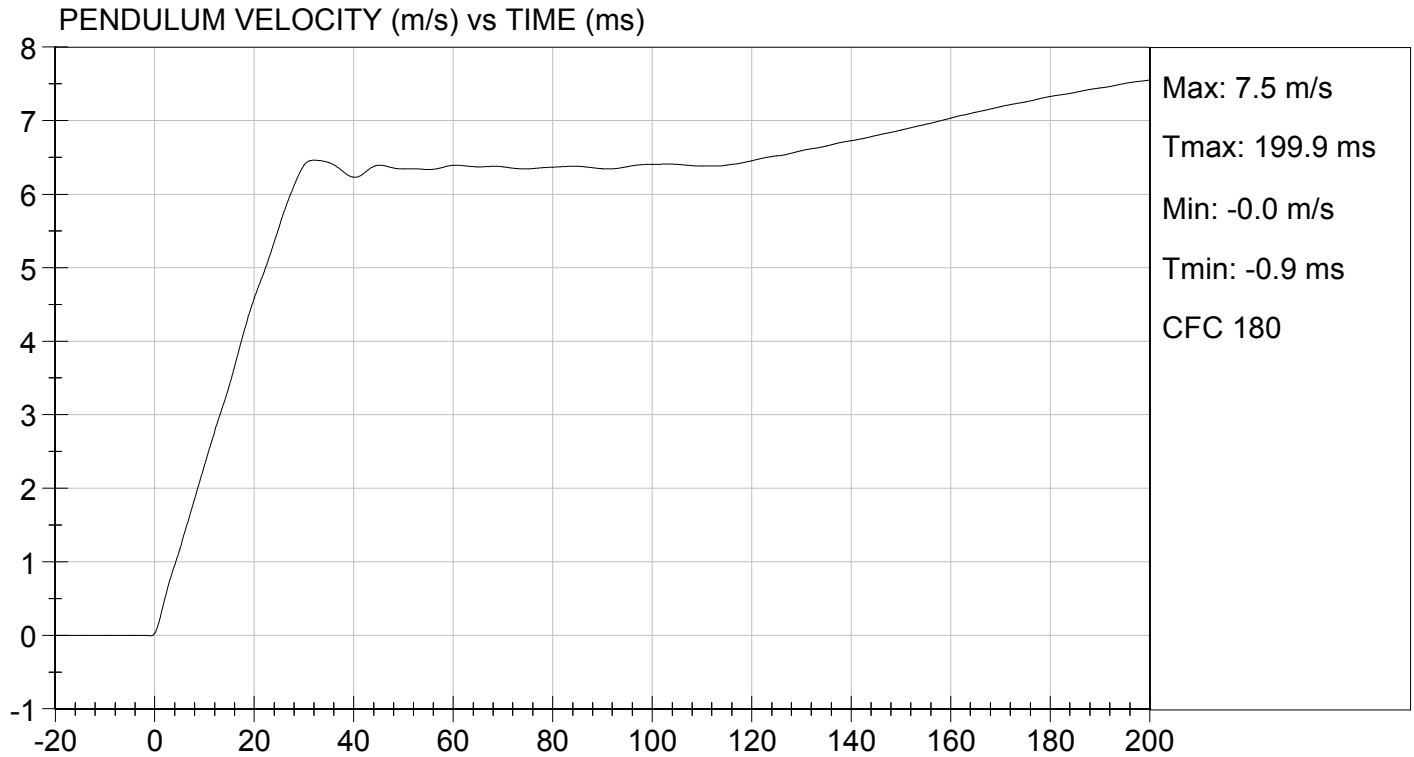
09/09/2014  
 Test Date

  
 Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 22.83 ft/s, 6.96 m/s

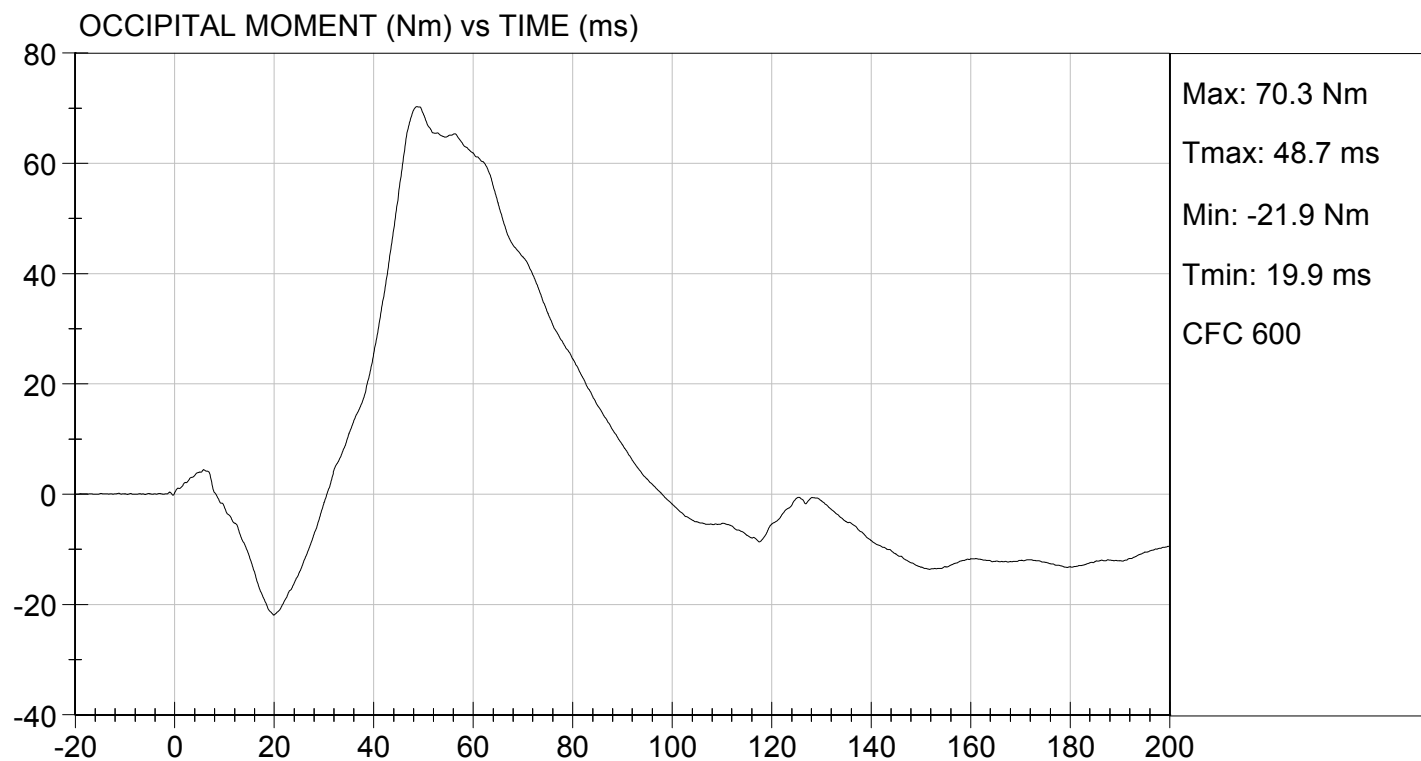
TEST DATE: 09/09/2014  
TEST #: D143072





TEST DESC: NECK FLEXION  
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 09/09/2014  
TEST #: D143072



**DATA SHEET B5**  
**NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

- Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X  1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 X  N/A, ONLY one neck test performed
- X  2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X  3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X  5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X  6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                              | Results              |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Pendulum impact speed                            |         | $5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$                                                                                                 | 6.12 m/s             |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$                                                                                                       | 1.7 m/s              |
|                                                  | @ 20 ms | $3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$                                                                                                       | 3.4 m/s              |
|                                                  | @ 30 ms | $4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$                                                                                                       | 5.0 m/s              |
| Plane D Rotation                                 |         | Peak moment*<br>$-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range<br>$99^\circ \leq \text{angle} \leq 114^\circ$ | -56 Nm @ 104 degrees |
| Positive Moment Decay** (Extension)              |         | Time to decay to -10 Nm<br>$94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$                                                                            | 102 ms               |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

Jessica Hall  
Signature

09/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

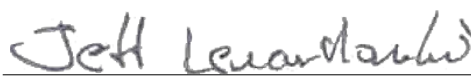
**ATD Serial No:** 124

**Test I.D:** D143073

| Tested Parameter                                  |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                            |       | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Laboratory Relative Humidity                      |       | %     | 10 to 70      | 47     | Pass      |
| Pendulum Speed                                    |       | m/s   | 5.95 to 6.19  | 6.12   | Pass      |
| Pendulum Velocity                                 | 10 ms | m/s   | 1.5 to 1.9    | 1.7    | Pass      |
|                                                   | 20 ms | m/s   | 3.1 to 3.9    | 3.4    | Pass      |
|                                                   | 30 ms | m/s   | 4.6 to 5.6    | 5.0    | Pass      |
| D Plane Rotation                                  | Max   | deg   | 99 to 114     | 104    | Pass      |
| Occipital Condyle Moment within Rotation Corridor |       | Nm    | -65 to -53    | -56    | Pass      |
| Negative Moment Time Curve Decay to -10 Nm        |       | ms    | 94 to 114     | 102    | Pass      |
| Overall Results                                   |       |       |               |        | Pass      |

  
 Laboratory Technician

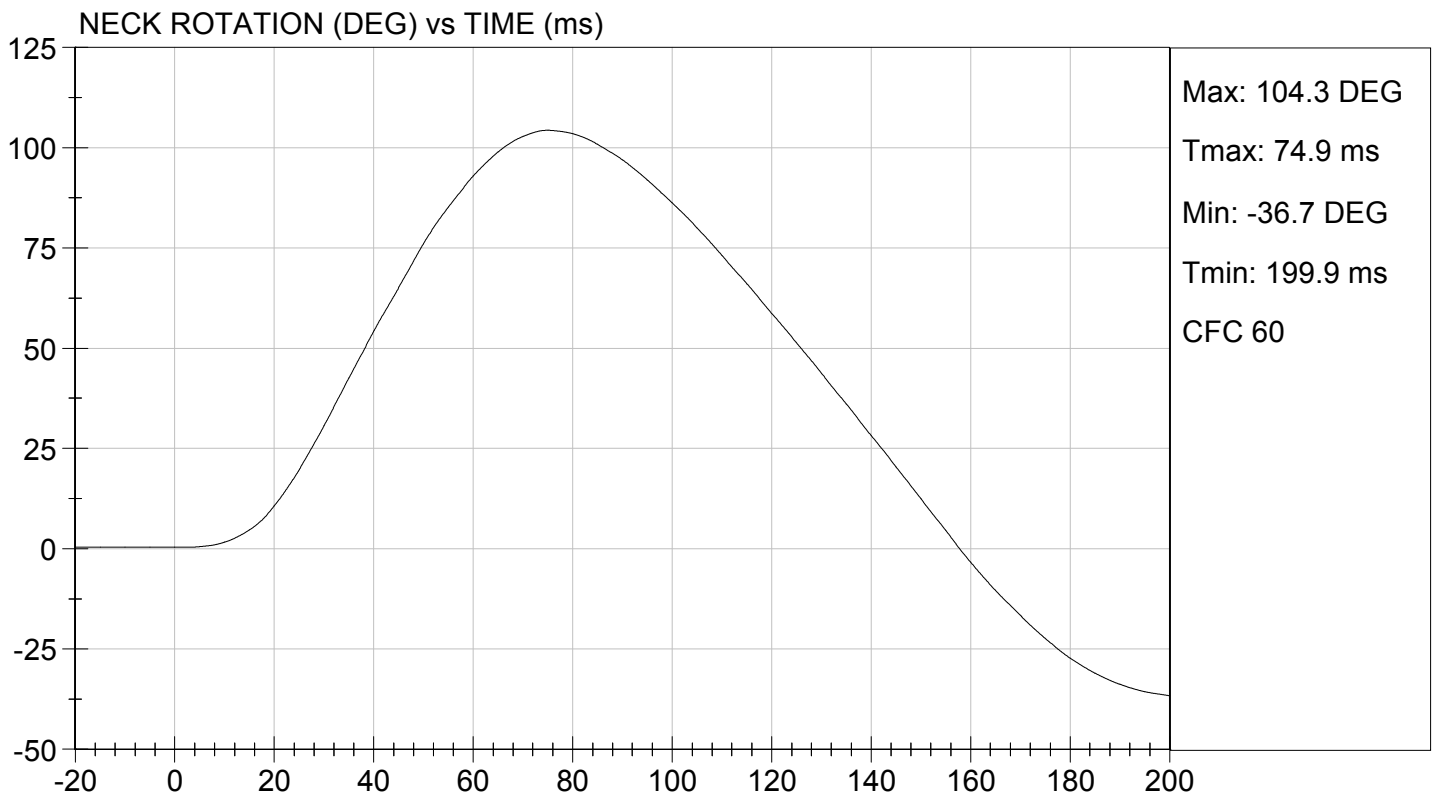
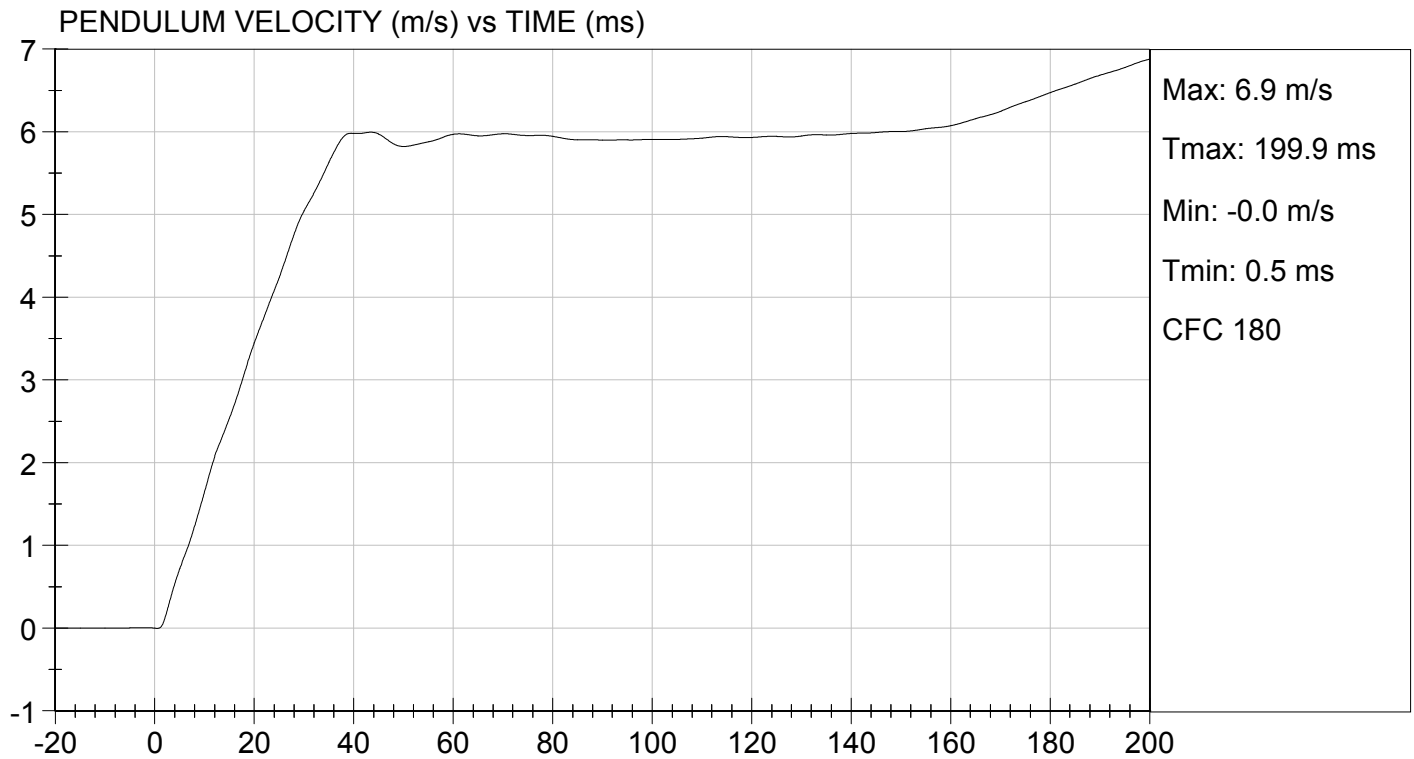
09/09/2014  
 Test Date

  
 Approved By



TEST DESC: NECK EXTENSION  
VELOCITY: 20.08 ft/s, 6.12 m/s

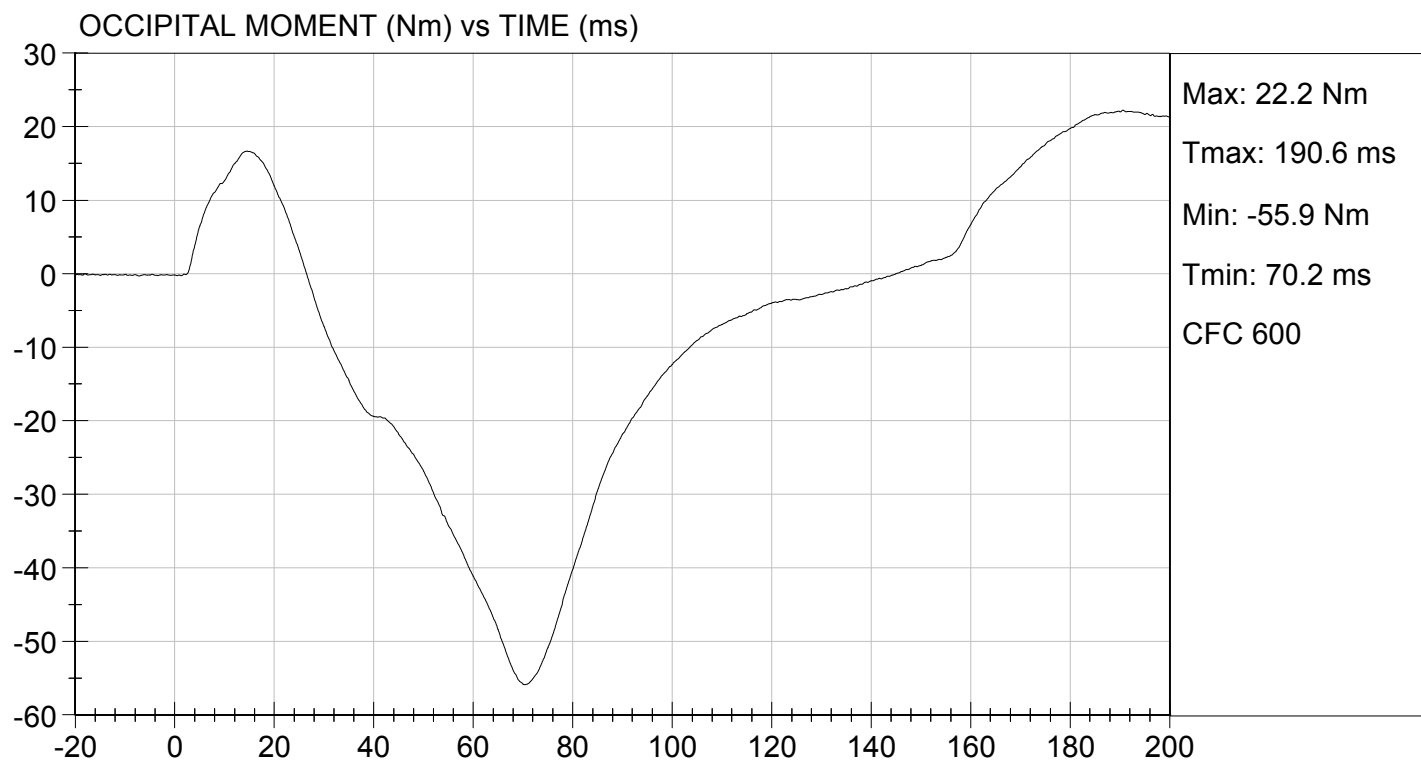
TEST DATE: 09/09/2014  
TEST #: D143073





TEST DESC: NECK EXTENSION  
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 09/09/2014  
TEST #: D143073



**DATA SHEET B6**  
**THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

     Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X 1. It has been at least 30 minutes since the last thorax impact test. (572.137(q))  
X N/A, ONLY one thorax impact test performed
- X 2. The test fixture conforms to the specifications in Figure 11B.
- X 3. The complete assembled dummy (880105-000) is used (572.134(b)) and is dressed in a form fitting cotton stretch above-the-elbow sleeved shirt and above-the-knee pants. The weight of the shirt and pants shall not exceed 0.14 kg. (572.134(c)(1))
- X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(2))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- X 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No Damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage:

     - The following repairs or replacement was performed. Record:

- X   6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X   7. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $7^\circ \pm 2^\circ$ . The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X   8. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.134(c)(3))
- X   9. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X   10. Align the adjustable neck bracket index marks to the "zero" position.
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X   16. Complete the following table:

### Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

| Parameter*                                              | Specification                             | Result   |
|---------------------------------------------------------|-------------------------------------------|----------|
| Test Probe Speed                                        | 6.59 m/s $\leq$ speed $\leq$ 6.83 m/s     | 6.60 m/s |
| Chest Compression                                       | 50.0 mm $\leq$ compression $\leq$ 58.0 mm | 55 mm    |
| Peak force** between 50.0 and 58.0 mm chest compression | 3900N $\leq$ peak force $\leq$ 4400N      | 4300 N   |
| Peak Force** between 18.0 and 50.0 mm chest compression | Peak Force $\leq$ 4600 N                  | 4226 N   |
| Internal Hysteresis***                                  | 69% $\leq$ hysteresis $\leq$ 85%          | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

**\*\*Force = impactor mass x acceleration (572.134(b)(3))**

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12B)

X 17. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Jessica Hall  
Signature

09/09/2014

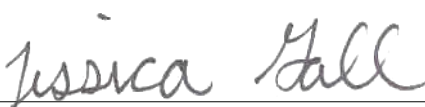
Date \_\_\_\_\_

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

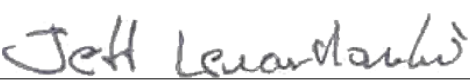
**Test I.D:** D143074

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.7   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 51     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.60   | Pass      |
| Peak Deflection                               | mm    | 50 to 58      | 55     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 3900 to 4400  | 4300   | Pass      |
| Internal Hysteresis                           | %     | 69 to 85      | 70     | Pass      |
| Peak Force 18 mm - 50 mm                      | N     | <= 4600       | 4226   | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

09/09/2014

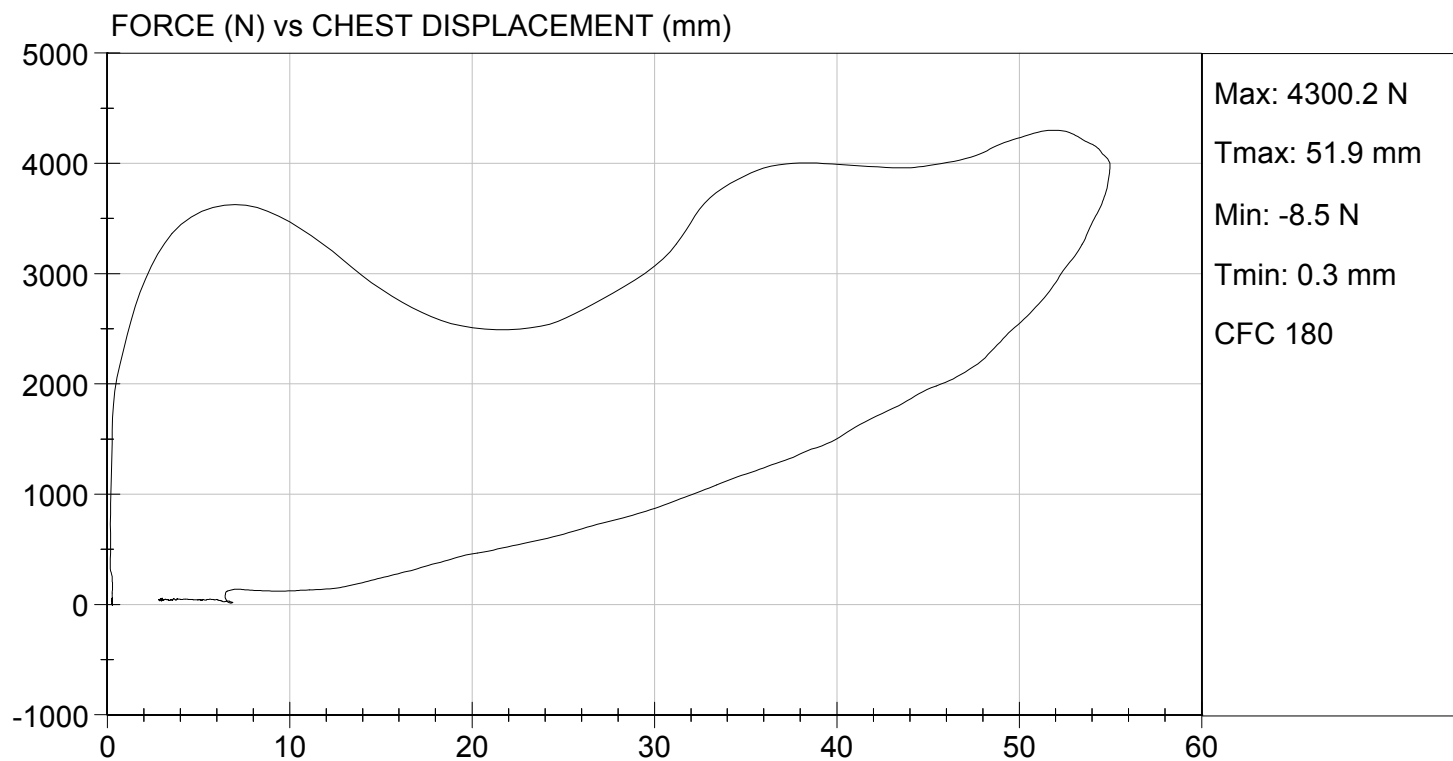
Test Date

  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 09/09/2014  
TEST #: D143074



**DATA SHEET B7**  
**TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X  1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
      X  N/A, ONLY one torso flexion test performed
- X  2. The test fixture conforms to the specifications in Figure 13B.
- X  3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
          With legs below femurs.  
      X  Without legs below femurs.
- X  4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X  5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X  6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X  7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X  8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X   9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X   10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X   11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))  
       Record reference plane angle (max. allowed 20°):                     See Result Table
- X   12. Attach the pull cable and the load cell. (572.135(c)(8))
- X   13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X   14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X   15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X   16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X   17. Complete the following table:  
                     Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

| Parameter                | Specification                 | Result      |
|--------------------------|-------------------------------|-------------|
| Initial ref. plane angle | Angle ≤ 20°                   | 20 deg      |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 0.9 deg/sec |
| Force at 45° ± 0.5°      | 320 N ≤ force ≤ 390 N         | 384 N       |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 21 deg      |

                    Jessica Hall                      
 Signature

                    09/09/2014                      
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143077

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.7   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 51     | Pass      |
| Initial Angle                | deg   | 0 to 20       | 20     | Pass      |
| Return Angle                 | deg   | +/- 8         | 21     | Pass      |
| Force at 45 deg              | N     | 320 to 390    | 384    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.9    | Pass      |
| Overall Result               |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

09/09/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET B8**  
**LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

     Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

- |   |     |                                                                                                                                                                                                                                                                        |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X | 10. | Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.<br>(572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.<br>(572.136(c)(6)) |
|---|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.12 m/s |
| Peak resistance force* | $3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$     | 3530 N   |

\*Force = impactor mass x deceleration (572.136(b)(2))

- X 12. Plots of acceleration versus time and force versus time follow this sheet.

Jessica Gall  
Signature

09/09/2014

---

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143076

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.5   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 49     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.12   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3530   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

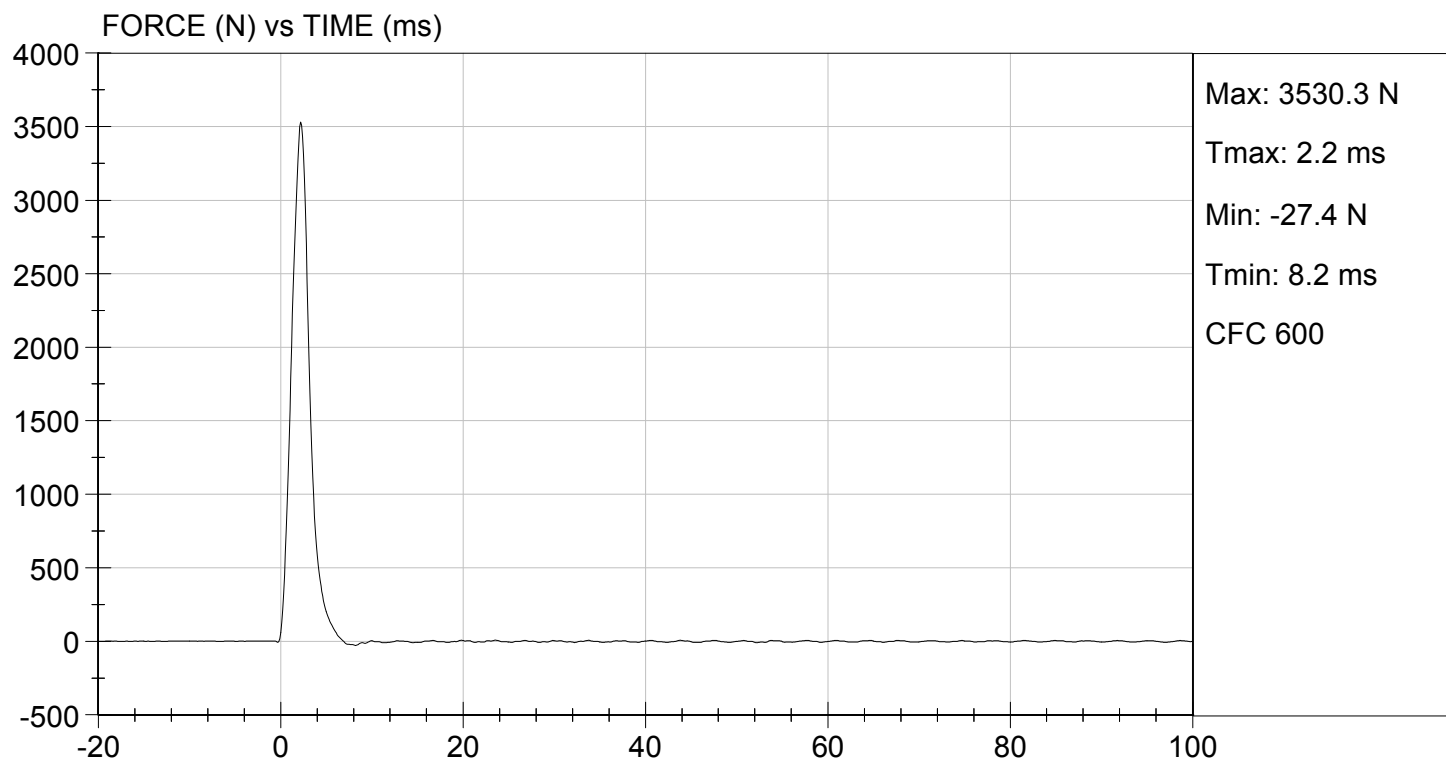
09/09/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.97 ft/s, 2.12 m/s

TEST DATE: 09/09/2014  
TEST #: D143076



**DATA SHEET B9**  
**RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)**

Dummy Serial Number: 124

Test Date: 09/09/2014

Technician: Jessica Gall

     Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528R), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-651), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

|                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>48%</u>    |
| Record the minimum humidity:    | <u>44%</u>    |

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

- X 11. Complete the following table:

| Parameter              | Specification                         | Result   |
|------------------------|---------------------------------------|----------|
| Probe speed            | 2.07 m/s $\leq$ speed $\leq$ 2.13 m/s | 2.11 m/s |
| Peak resistance force* | 3450 N $\leq$ force $\leq$ 4060 N     | 3803 N   |

X 12. Plots of acceleration versus time and force versus time follow this sheet.

  
Signature

09/09/2014

---

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 124

**Test I.D:** D143075

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.5   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 49     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.11   | Pass      |
| Maximum Force                | N     | 3450 to 4060  | 3803   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Gall  
Laboratory Technician

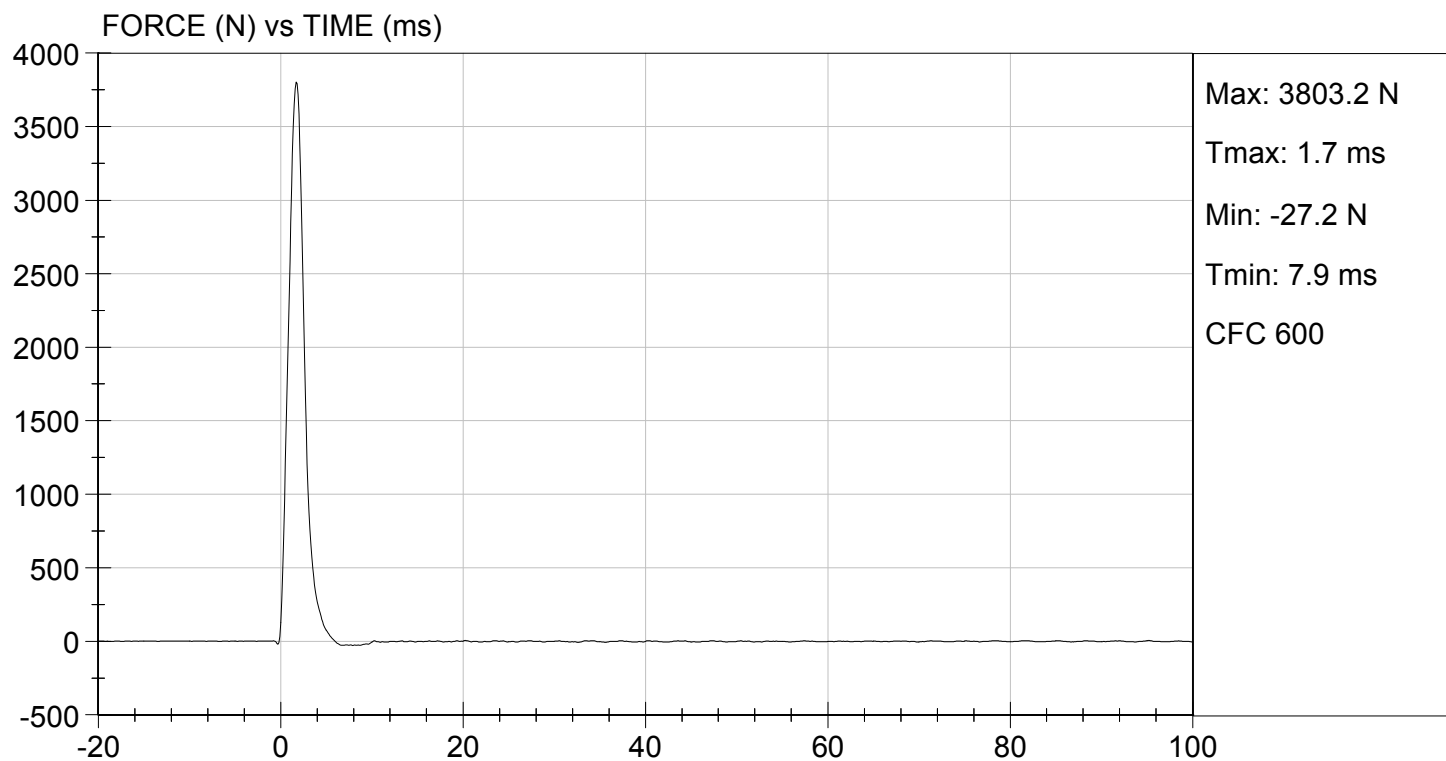
09/09/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 09/09/2014  
TEST #: D143075



# DATA SHEET B10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78702     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78777     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78781     | 07/02/2014               | 01/02/2015               |
| NECK TRANSDUCER                       | Denton       | 2320                | 2320       | 05/30/2014               | 11/30/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79695     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79696     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79740     | 07/02/2014               | 01/02/2015               |
| CHEST POTENTIOMETER                   | Servo        | 14CBI-2897          | 124        | 07/08/2014               | 01/08/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | Denton       | 2121                | 1361       | 04/23/2014               | 10/23/2014               |
| (2) LEFT FEMUR                        | Denton       | 2121                | 1362       | 04/23/2014               | 10/23/2014               |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2015               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/01/2014               |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 124

Test Date: 09/08/2014

Technician: Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damage | OK |
|-----------------------------|--------------------------------------------------------------|----------|--------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |        | X  |
| Head                        | Ballast secure                                               |          |        | X  |
|                             | General appearance                                           |          |        | X  |
| Neck                        | Broken or cracked rubber                                     |          |        | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |        | X  |
|                             | Looseness at the condyle joint                               |          |        | X  |
|                             | Nodding blocks cracked or out of position                    |          |        | X  |
| Spine                       | Broken or cracks in rubber                                   |          |        | X  |
| Ribs                        | Broken or bent ribs                                          |          |        | X  |
|                             | Broken or bent rib supports                                  |          |        | X  |
|                             | Damping material separated or cracked                        |          |        | X  |
|                             | Rubber bumpers in place                                      |          |        | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |        | X  |
|                             | Slider arm riding in track                                   |          |        | X  |
| Transducer leads            | Torn cables                                                  |          |        | X  |
| Accelerometer Mountings     | Head mounting secure                                         |          |        | X  |
|                             | Chest mounting secure                                        |          |        | X  |
| Knees                       | Skin condition                                               |          |        | X  |
|                             | Insert (do not remove)                                       |          |        | X  |
|                             | Casting                                                      |          |        | X  |
| Limbs                       | Normal movement and adjustment                               |          |        | X  |
| Knee Sliders                | Wires intact                                                 |          |        | X  |
|                             | Rubber returned to "at rest" position                        |          |        | X  |
| Pelvis                      | Broken                                                       |          |        | X  |
| Other                       |                                                              |          |        | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

09/09/2014  
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard  
Signature

09/09/2014  
Date

## EXTERNAL DIMENSIONS

| HYBRID III 6 year-old SN #155, PART 572, SUBPART N EXTERNAL DIMENSIONS |                                |                                                                                                                                                                                    |                         |                    |
|------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                              | DESCRIPTION                    | DETAILS                                                                                                                                                                            | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                                      | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                                                                  | 622.3 - 647.7           | 628.2              |
| B                                                                      | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                                                             | 348.0 - 363.2           | 362.0              |
| C                                                                      | H-POINT HEIGHT                 | Reference                                                                                                                                                                          | 63.5 - 73.7             | 68.3               |
| D                                                                      | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                                                          | 88.9 - 99.1             | 94.5               |
| E                                                                      | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder clevis to the rear vertical surface of the fixture.                                                                                                         | 53.3 - 63.5             | 61.7               |
| F                                                                      | THIGH CLEARANCE                | Measured at the highest point on the upper femur segment.                                                                                                                          | 88.9 - 104.1            | 102.0              |
| G                                                                      | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots                                                                                                 | 182.9 - 198.1           | 195.4              |
| H                                                                      | HEAD BACK TO BACKLINE          | Back of Skull cap skin to seat rear vertical surface (Reference)                                                                                                                   | 17.8 - 22.8             | 22.1               |
| I                                                                      | SHOULDER TO ELBOW LENGTH       | Measure from the highest point on top of the broad upper surface of clavicle link below the collar to the lowest part of the flesh of the elbow in line with the elbow pivot bolt. | 215.9 - 231.1           | 219.5              |
| J                                                                      | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                                                             | 157.4 - 177.8           | 165.0              |
| K                                                                      | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the rear vertical surface of the fixture.                                                                                               | 370.8 - 391.2           | 390.7              |
| L                                                                      | POPLITEAL HEIGHT               | Seat surface to the horizontal plane at the bottom of the feet.                                                                                                                    | 269.2 - 289.6           | 273.6              |
| M                                                                      | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                                                                   | 307.4 - 322.6           | 313.8              |

| HYBRID III 6 year-old SN #155, PART 572, SUBPART N EXTERNAL DIMENSIONS, continued |                                                              |                                                                                                                |                         |                    |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                         | DESCRIPTION                                                  | DETAILS                                                                                                        | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| N                                                                                 | BUTTOCK POPLITEAL LENGTH                                     | The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K". | 320.0 - 340.4           | 322.4              |
| O                                                                                 | CHEST DEPTH WITHOUT JACKET                                   | Measured 330.2 ± 5.1 mm above seat surface                                                                     | 129.6 - 144.8           | 140.2              |
| P                                                                                 | FOOT LENGTH                                                  | Tip of toe to rear of heel                                                                                     | 170.2 - 185.4           | 173.4              |
| Q                                                                                 | STATURE                                                      | (THEORETICAL) (Q = A - C - D + R + M)                                                                          | 1099.9 - 1181.1         | N/A                |
| R                                                                                 | BUTTOCK TO KNEE PIVOT LENGTH                                 | The rear surface of the buttocks to the knee pivot bolt                                                        | 342.9 - 363.3           | 355.7              |
| S                                                                                 | HEAD BREADTH                                                 | The widest part of the head                                                                                    | 137.1 - 147.3           | 139.0              |
| T                                                                                 | HEAD DEPTH                                                   | Back of the head to the forehead                                                                               | 167.6 - 177.8           | 174.2              |
| U                                                                                 | HIP BREADTH                                                  | The widest part of the hips                                                                                    | 208.3 - 223.5           | 221.5              |
| V                                                                                 | SHOULDER BREADTH                                             | Outside shoulder edges, in line with the shoulder pivot bolts                                                  | 259.1 - 274.3           | 272.1              |
| W                                                                                 | FOOT BREADTH                                                 | The widest part of the foot                                                                                    | 62.3 - 77.5             | 66.0               |
| X                                                                                 | HEAD CIRCUMFERENCE                                           | Measured at the point as in dim. "I"                                                                           | 510.5 - 530.9           | 529.3              |
| Y                                                                                 | CHEST CIRCUMFERENCE (WITH CHEST JACKET)                      | Measured 3330.2 ± 5.1 mm above seat surface                                                                    | 596.9 - 622.3           | 609.5              |
| Z                                                                                 | WAIST CIRCUMFERENCE (with chest jacket and abdominal insert) | Measured 158.8 ± 5.1 mm above seat surface                                                                     | 558.8 - 584.2           | 583.2              |
| AA                                                                                | REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE    | Reference                                                                                                      | 325.1 - 335.3           | 330.0              |
| BB                                                                                | REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE    | Reference                                                                                                      | 153.7 - 163.9           | 159.0              |

**DATA SHEET C3**  
**HEAD DROP TEST (572.122) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: Joseph Radke

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive head drop tests are necessary)

- X 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))  
    X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- X 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- |                              |                  |
|------------------------------|------------------|
| Record findings and actions: | <u>No Damage</u> |
|------------------------------|------------------|
- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

- X   10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface.

Record the actual distance: 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X   11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

- X   12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2155.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 33.8 micro inches

- X   13. The impact surface is rigidly supported. (572.122(c)(4))

- X   14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

- X   15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

- X   16. Complete the following table using channel class 1000 data. (572.122(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $245 \text{ g} \leq x \leq 300 \text{ g}$        | 284 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 3.6 g  |

- X   17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Joseph Radtke  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

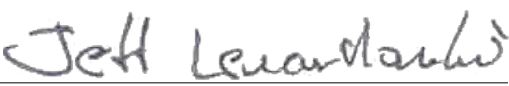
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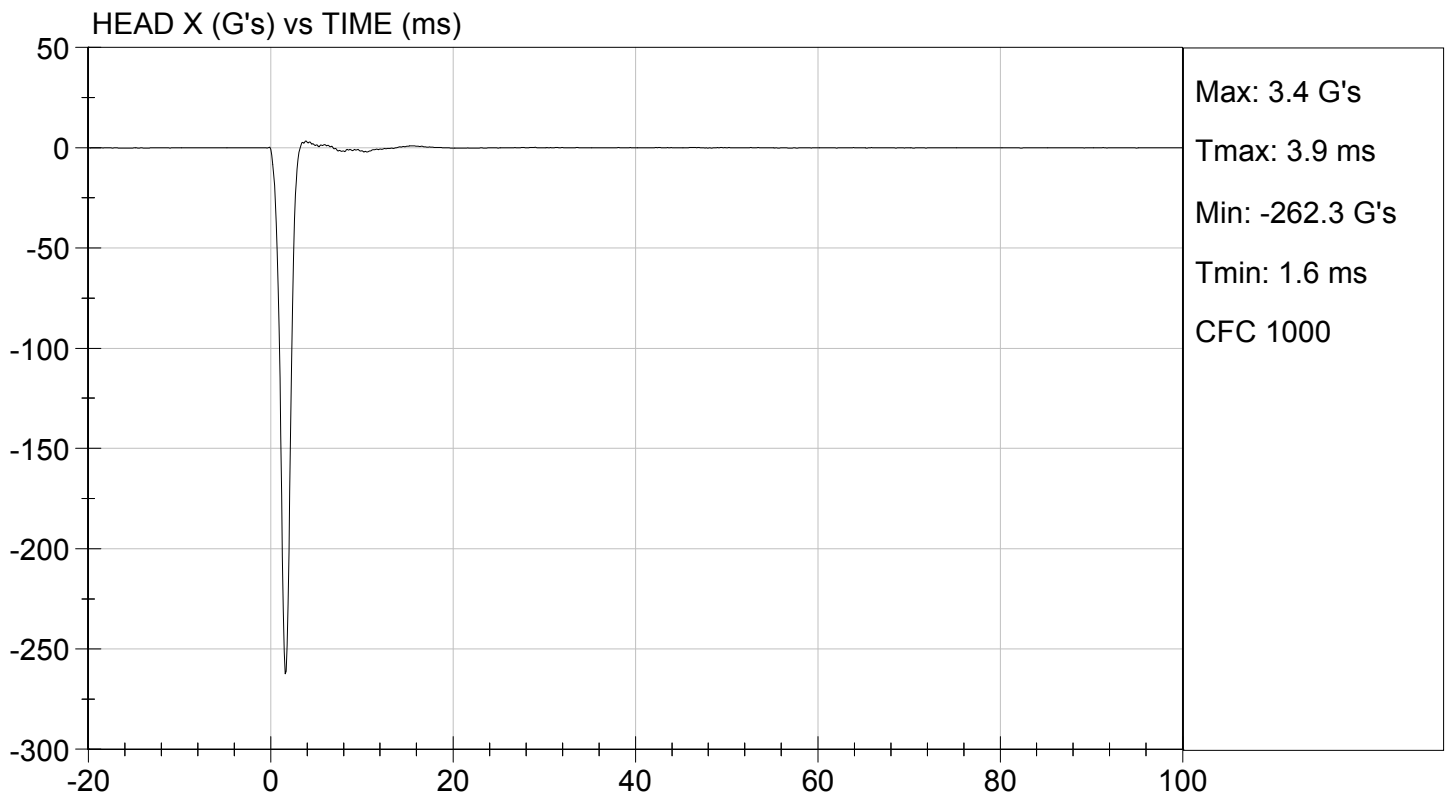
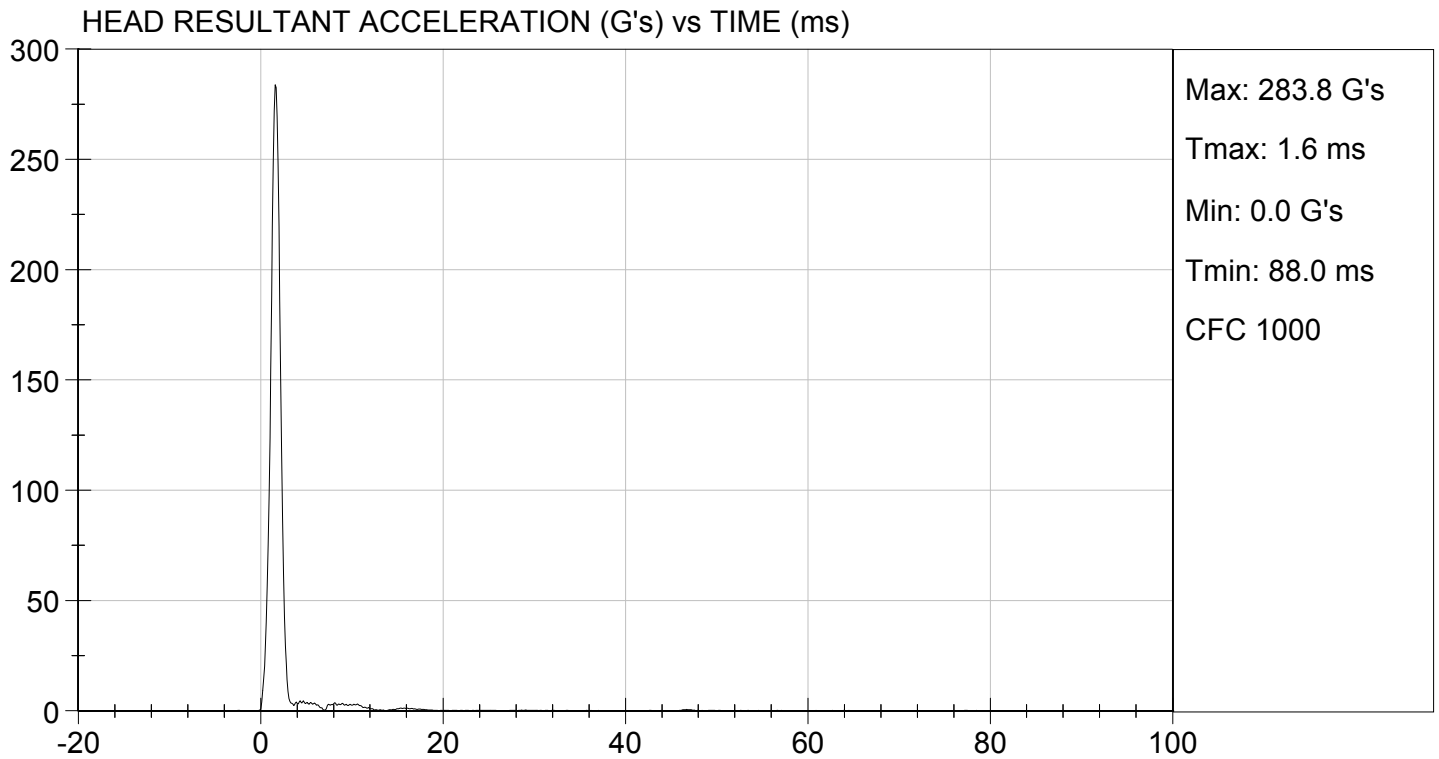
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 45     | Pass      |
| Peak Resultant Acceleration  | G's   | 245 to 300         | 284    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 3.6    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

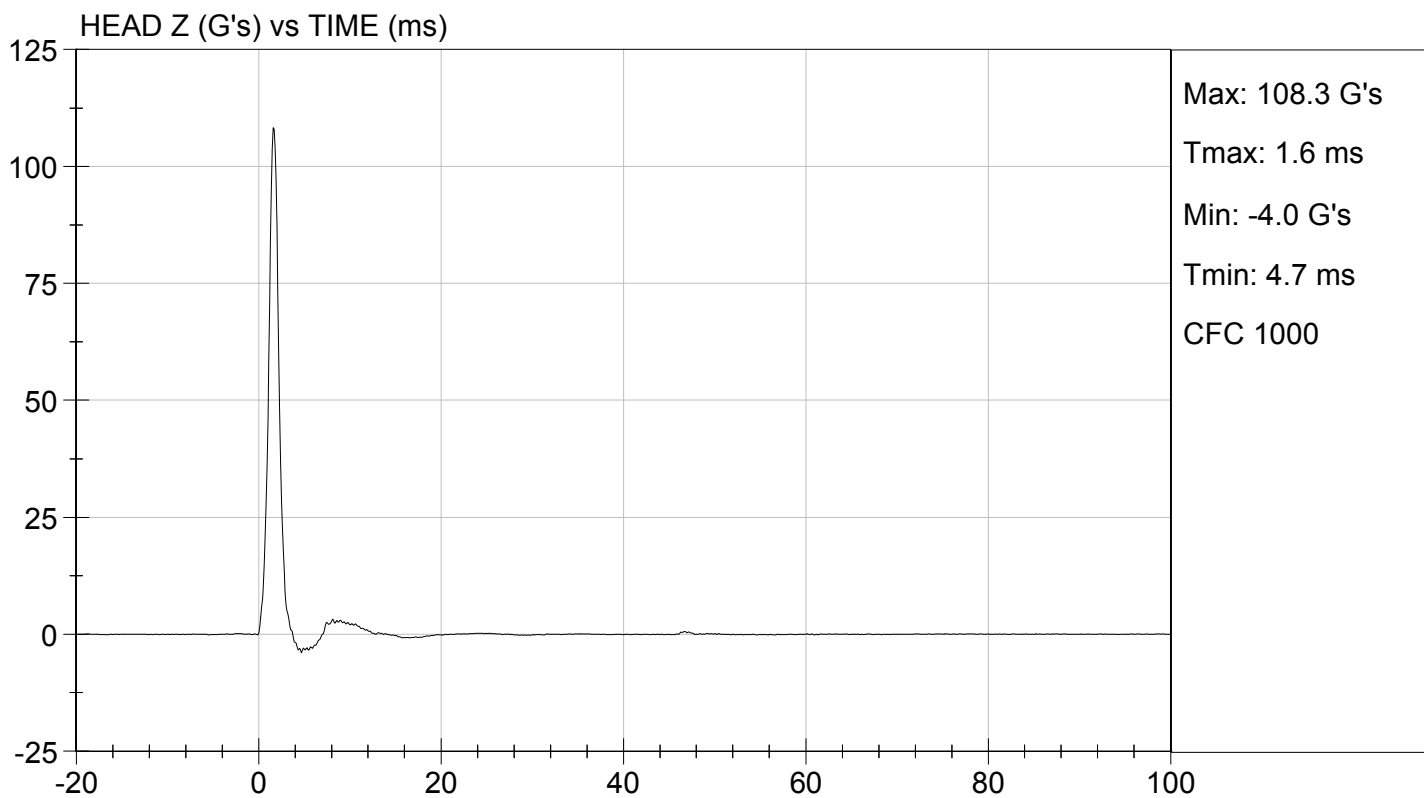
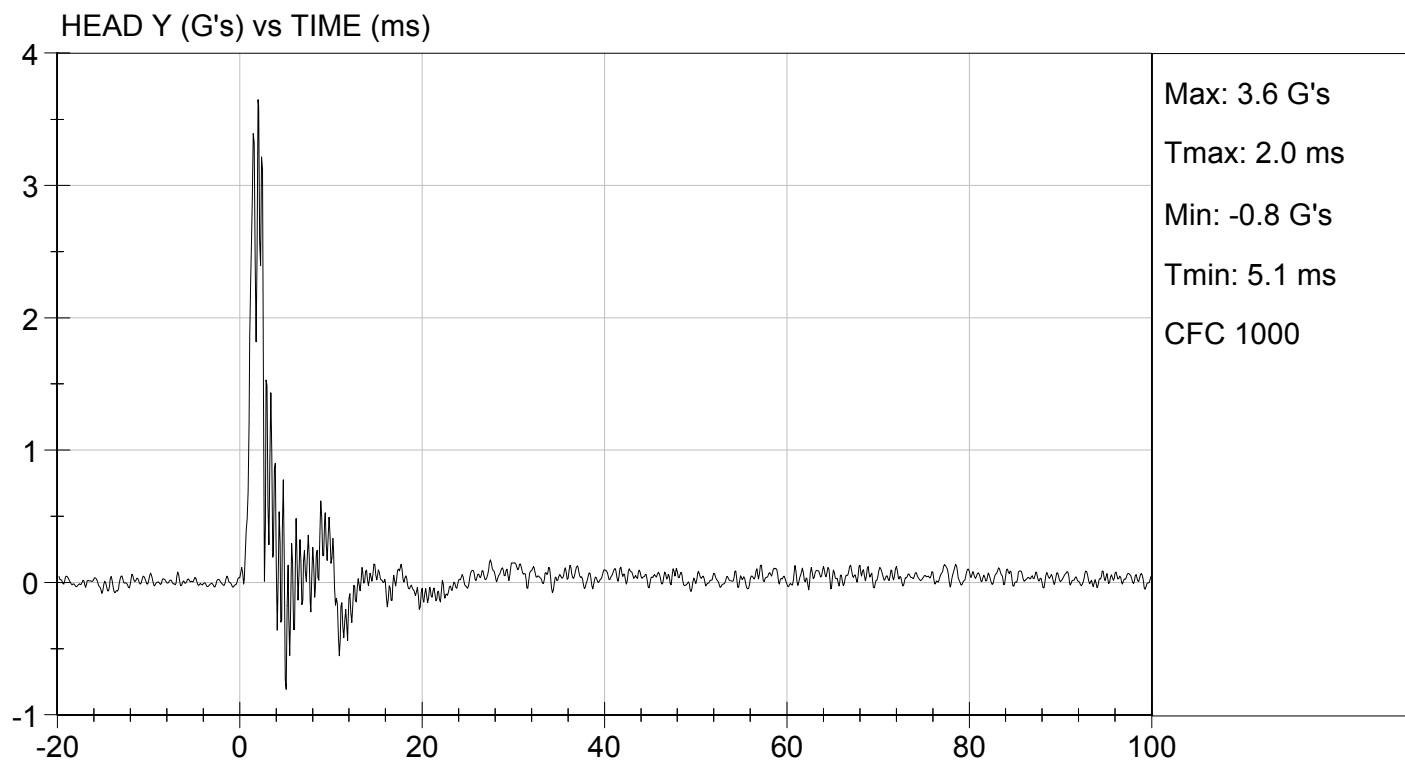
  
Laboratory Technician

07/09/2014

Test Date

  
Approved By





**DATA SHEET C4**  
**NECK FLEXION TEST (572.123) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: David Schoedel

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
☒ N/A, ONLY one neck test performed
- ☒ 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- ☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- ☒ 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
- ☒ 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- ☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

- X   8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))
- X   9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123I(3))
- X   10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X   11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123I(4)(i))
- X   12. Complete the following table:

Neck Flexion Test Results (572.123(b)(1)) & (572.123(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                    | Result             |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | 4.83 m/s $\leq$ speed $\leq$ 5.07 m/s                                                                            | 4.83 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | 1.2 m/s $\leq \Delta V \leq$ 1.6 m/s                                                                             | 1.6 m/s            |
|                                                  | @ 20 ms | 2.4 m/s $\leq \Delta V \leq$ 3.4 m/s                                                                             | 2.9 m/s            |
|                                                  | @ 30 ms | 3.8 m/s $\leq \Delta V \leq$ 5.0 m/s                                                                             | 4.1 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>27 Nm $\leq$ moment $\leq$ 33 Nm during the following rotation range 74° $\leq$ angle $\leq$ 92° | 28 Nm @ 77 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 5 Nm 103 ms $\leq$ time $\leq$ 123 ms                                                           | 108 ms             |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(1)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- X   13. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST  
HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D142412

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                                      |       | m/s   | 4.83 to 5.07  | 4.83   | Pass      |
| Pendulum Velocity                                   | 10 ms | m/s   | 1.2 to 1.6    | 1.6    | Pass      |
|                                                     | 20 ms | m/s   | 2.4 to 3.4    | 2.9    | Pass      |
|                                                     | 30 ms | m/s   | 3.8 to 5.0    | 4.1    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 74 to 92      | 77     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | 27 to 33      | 28     | Pass      |
| Positive Moment Time Curve Decay to 5 Nm            |       | ms    | 103 to 123    | 108    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

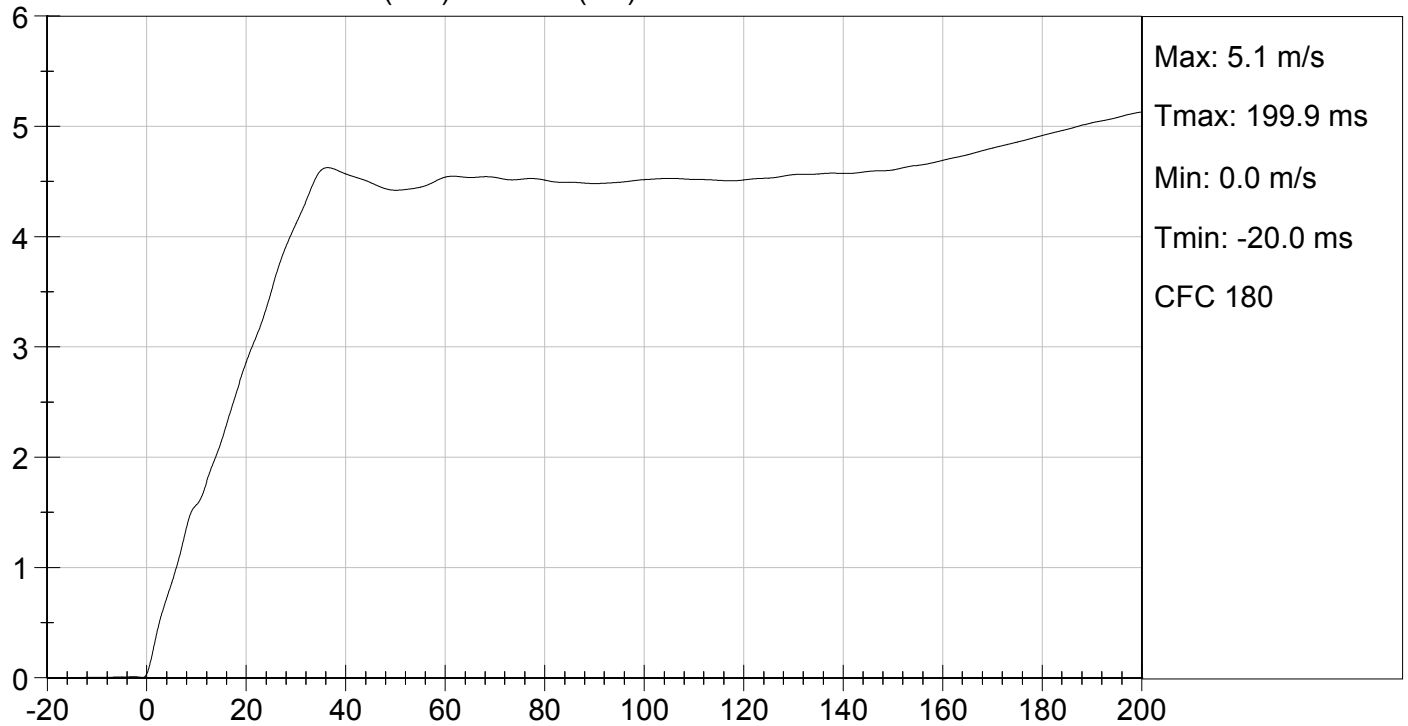
David Schoedel  
Laboratory Technician

07/09/2014  
Test Date

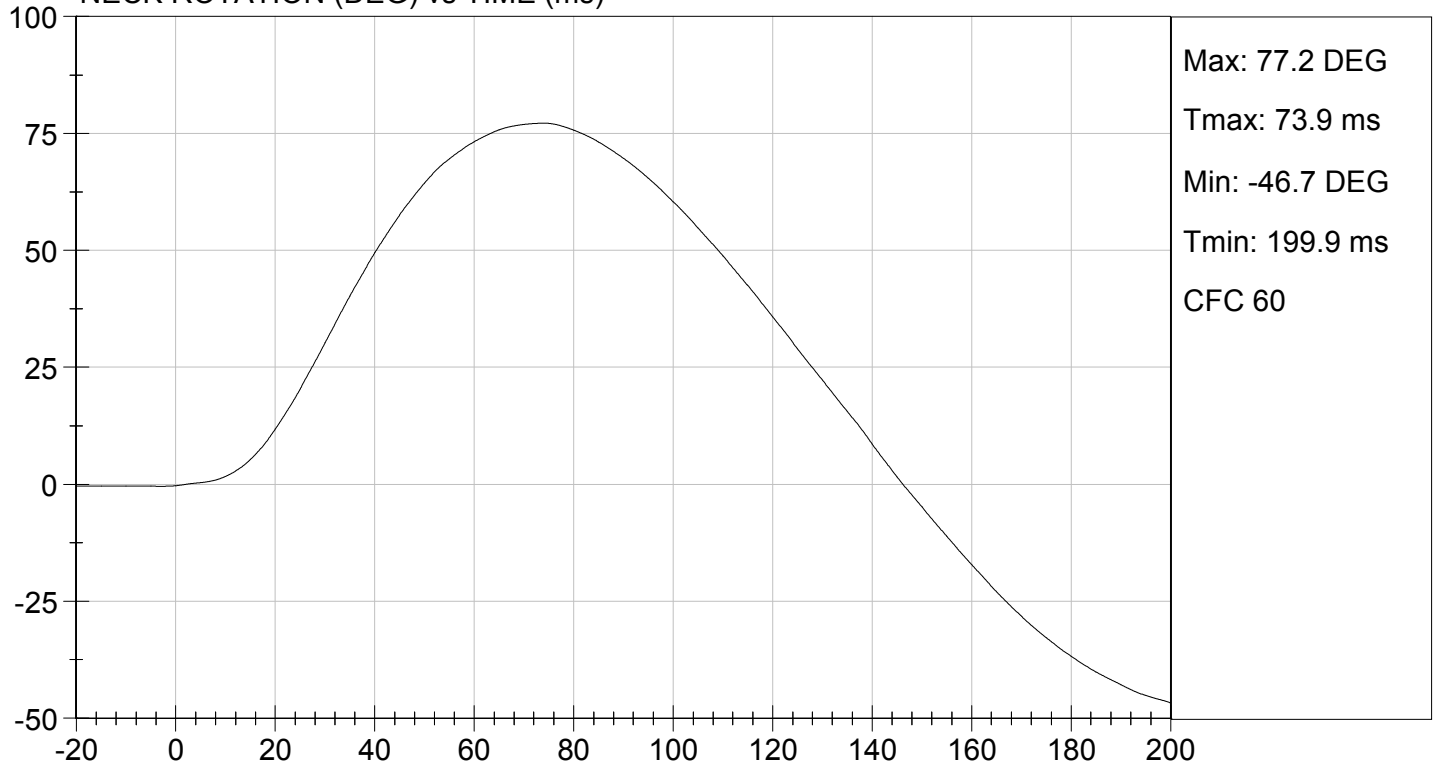
Jeff Leonard  
Approved By



PENDULUM VELOCITY (m/s) vs TIME (ms)



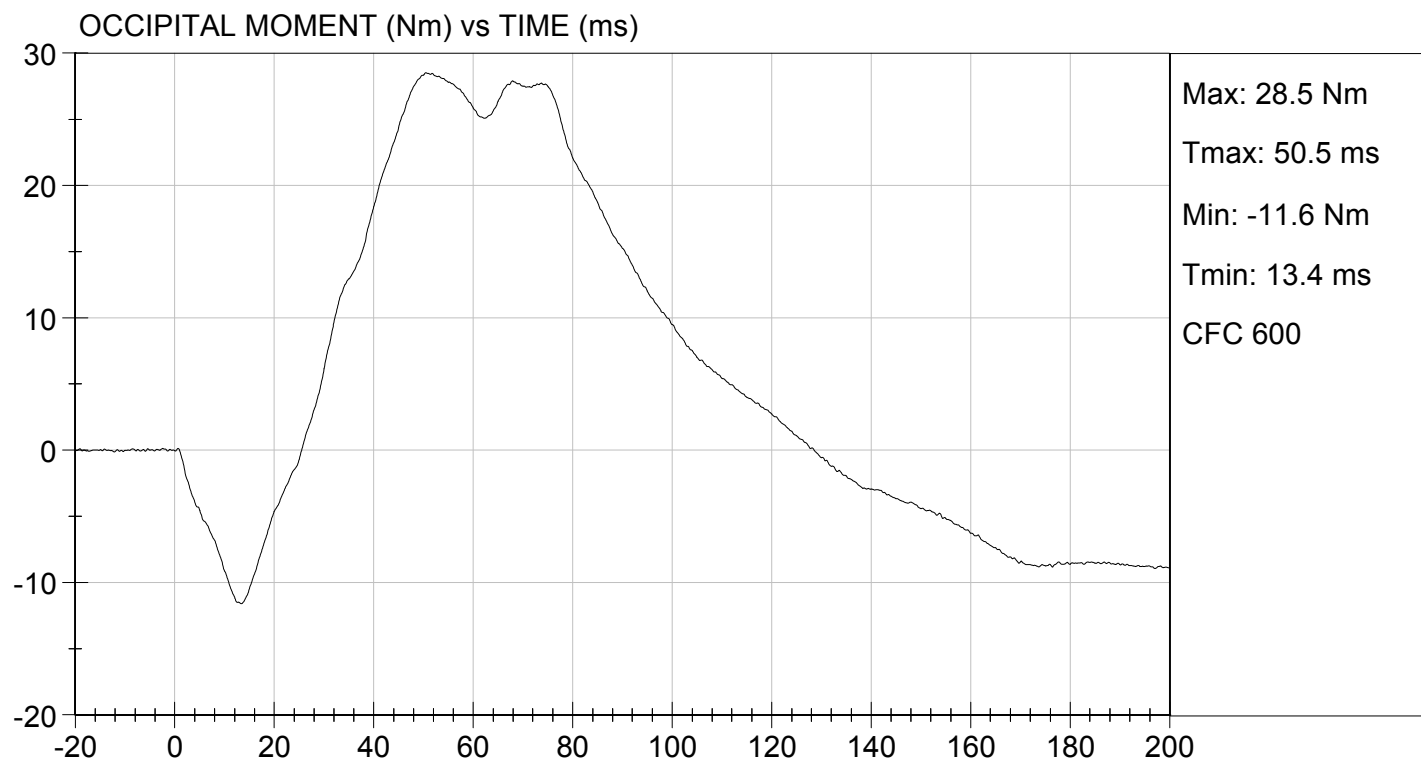
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK FLEXION  
VELOCITY: 15.85 ft/s, 4.83 m/s

TEST DATE: 07/09/2014  
TEST #: D142412



**DATA SHEET C5**  
**NECK EXTENSION TEST (572.123) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
    X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage

- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to  $0.23 \pm 0.02$  Nm ( $2.0 \pm 0.2$  in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.123(b)(2)) & (572.123(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                                                           | Result              |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Pendulum impact speed                            |         | $4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$                                                                                              | 4.20 m/s            |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$                                                                                                    | 1.4 m/s             |
|                                                  | @ 20 ms | $2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$                                                                                                    | 2.6 m/s             |
|                                                  | @ 30 ms | $3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$                                                                                                    | 3.8 m/s             |
| Plane D Rotation                                 |         | Peak moment*<br>$-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq \text{angle} \leq 103^\circ$ | -22 Nm @ 93 degrees |
| Negative Moment Decay** (Extension)              |         | Time to decay to -5 Nm $123 \text{ ms} \leq \text{time} \leq 147 \text{ ms}$                                                                            | 133 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(2)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

07/09/2014  
Date

## MGA RESEARCH CORPORATION

## NECK EXTENSION TEST

## HYBRID III 6 YEAR OLD

ATD Serial No: 155Test I.D: D142413

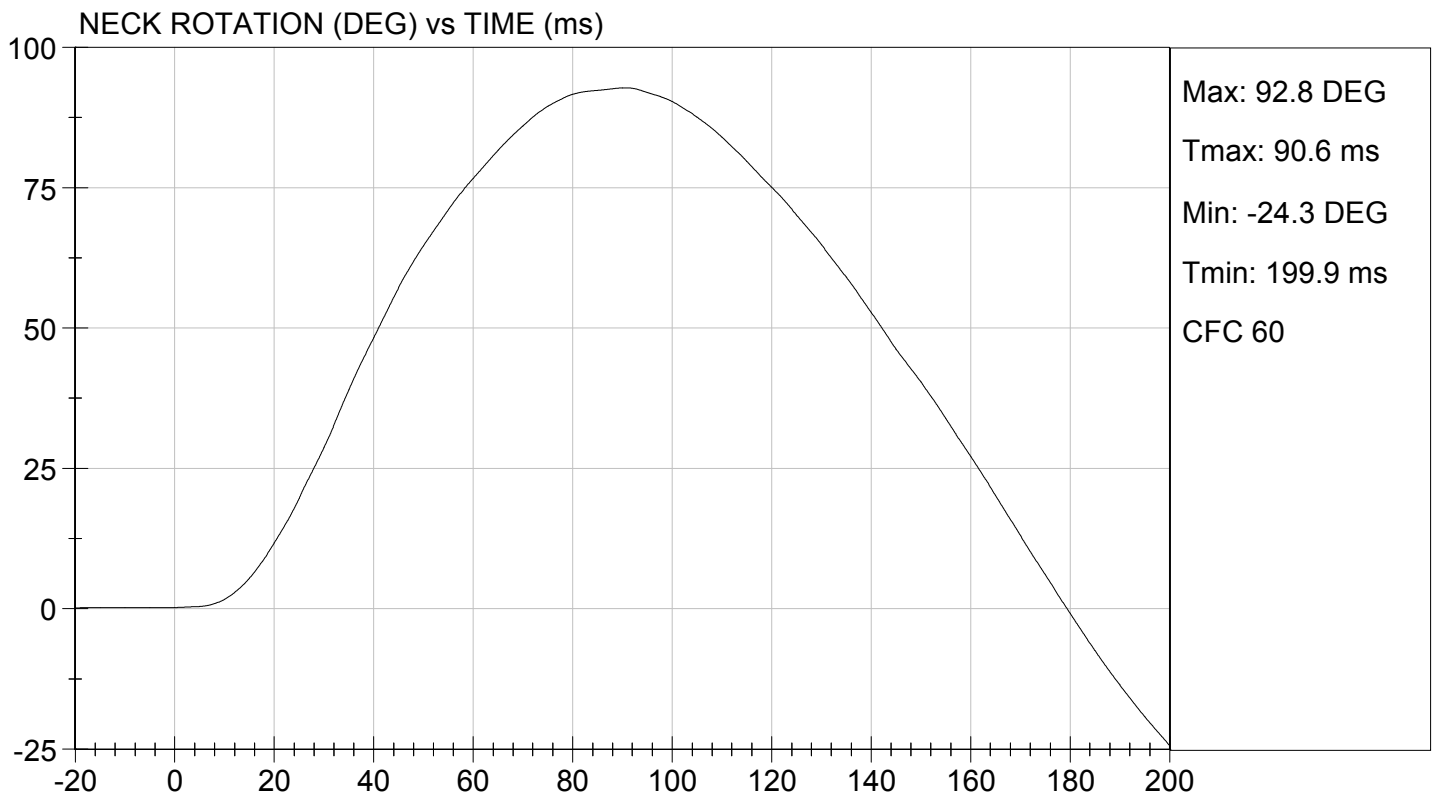
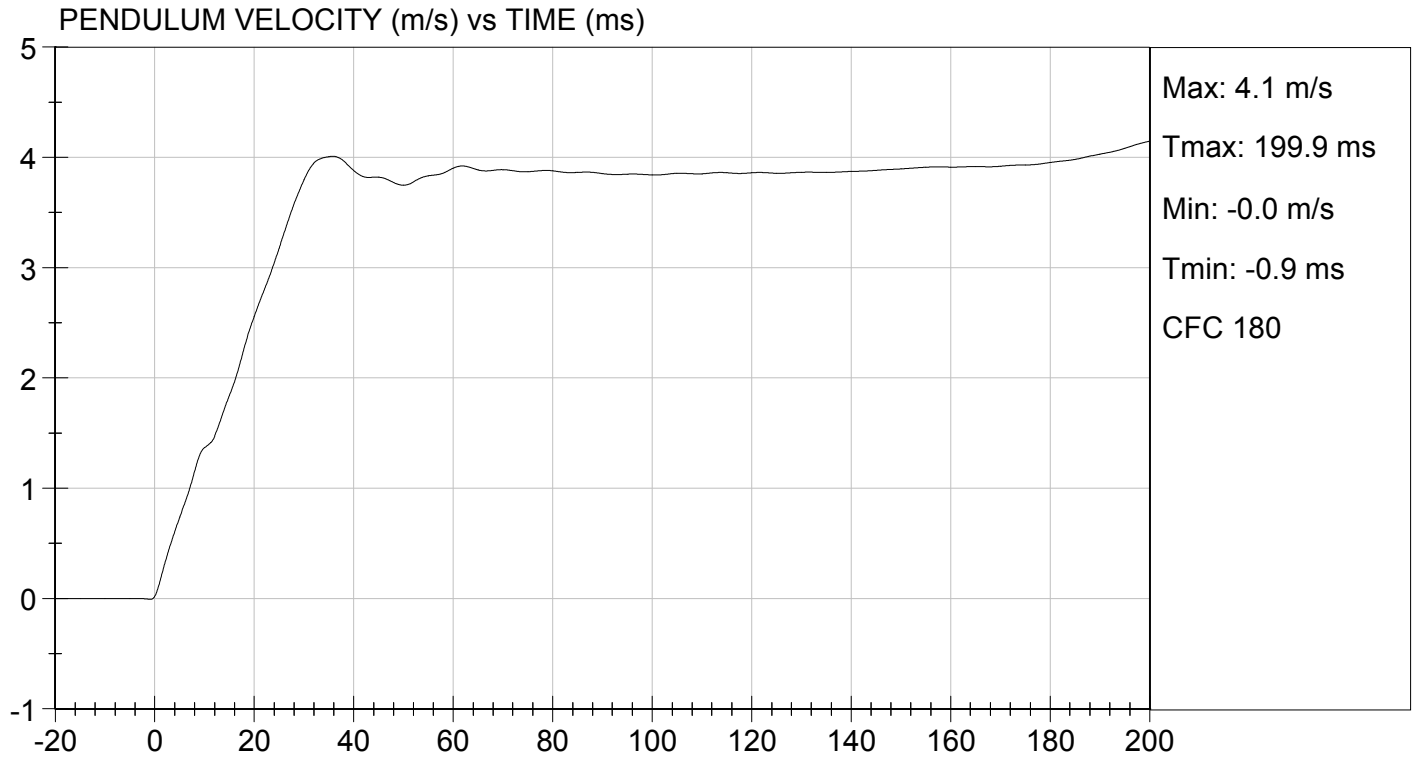
| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                                      |       | m/s   | 4.18 to 4.42  | 4.20   | Pass      |
| Pendulum Velocity                                   | 10 ms | m/s   | 1.0 to 1.4    | 1.4    | Pass      |
|                                                     | 20 ms | m/s   | 2.2 to 3.0    | 2.6    | Pass      |
|                                                     | 30 ms | m/s   | 3.2 to 4.2    | 3.8    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 85 to 103     | 93     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | -19 to -24    | -22    | Pass      |
| Positive Moment Time Curve Decay to 5 Nm            |       | msec  | 123 to 147    | 133    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

07/09/2014

Test Date

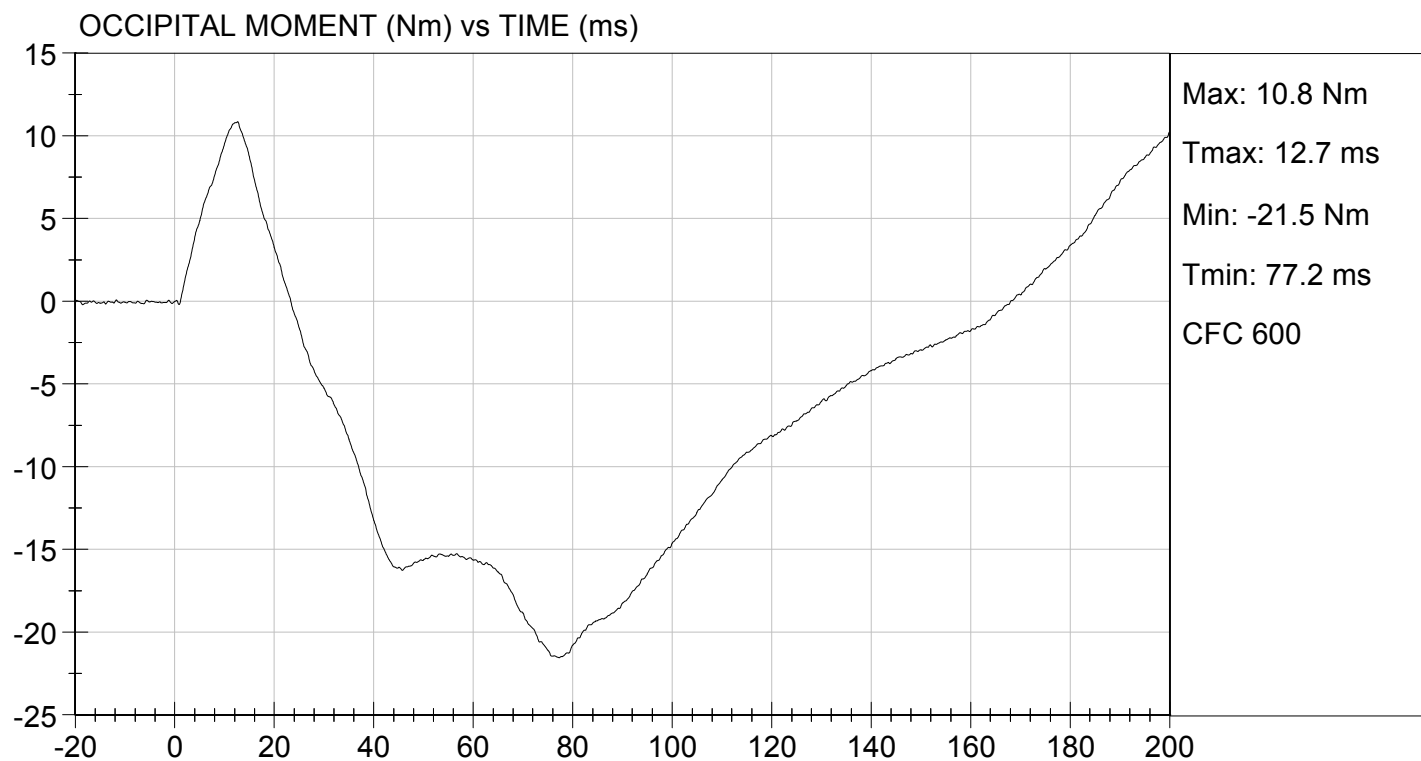
Jeff Leonard  
Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 13.77 ft/s, 4.20 m/s

TEST DATE: 07/09/2014  
TEST #: D142413



**DATA SHEET C6**  
**THORAX IMPACT TEST (572.124) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: Joseph Radke

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X 1. It has been at least 30 minutes since the last thorax impact test. (572.127(o))  
    X N/A, ONLY one thorax impact test performed

- X 2. The test fixture conforms to the specifications in Figure 11C.

- X 3. The complete assembled dummy (127-0000) is used (572.124(b)).

- X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(1))

|                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |

- X 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

Record findings and actions:

- X - No damage  
     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.

     - The following repairs or replacement was performed. Record damage.

- X 6. The dummy is dressed in a size 4 pair of long pants having a weight of less than 0.090 kg (0.2 lb) with the legs cut off sufficiently above the knee to allow the knee target to be visible. (572.124(c)(2))

- X   7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))
- X   8. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $8^\circ \pm 2^\circ$ . The angle may be measured at the pelvis lumbar joining surface.
- X   9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.124(c)(3))
- X   10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X   12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X   13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X   14. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X   15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X   16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

| Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2) |                                                                |          |
|----------------------------------------------------------|----------------------------------------------------------------|----------|
| Parameter*                                               | Specification                                                  | Result   |
| Test Probe Speed                                         | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.77 m/s |
| Chest Compression                                        | $38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$ | 43.7 mm  |
| Peak force** between 38.0 and 46.0 mm chest compression  | $1150\text{N} \leq \text{peak force} \leq 1380\text{N}$        | 1254 N   |
| Peak force** between 12.5 and 38.0 mm chest compression  | Peak force $\leq 1500 \text{ N}$                               | 1258 N   |
| Internal Hysteresis***                                   | $65\% \leq \text{hysteresis} \leq 85\%$                        | 71%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

X 18. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

Joseph Radke  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 6 YEAR OLD**

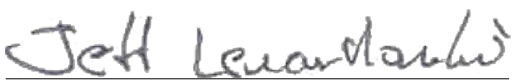
**ATD Serial No:** 155

**Test I.D:** D142414

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 44     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.77   | Pass      |
| Peak Deflection                               | mm    | 38.0 to 46.0  | 43.7   | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 1150 to 1380  | 1,254  | Pass      |
| Internal Hysteresis                           | %     | 65 to 85      | 71     | Pass      |
| Peak Force 12.5 mm - 38.0 mm                  | N     | <= 1,500      | 1,258  | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

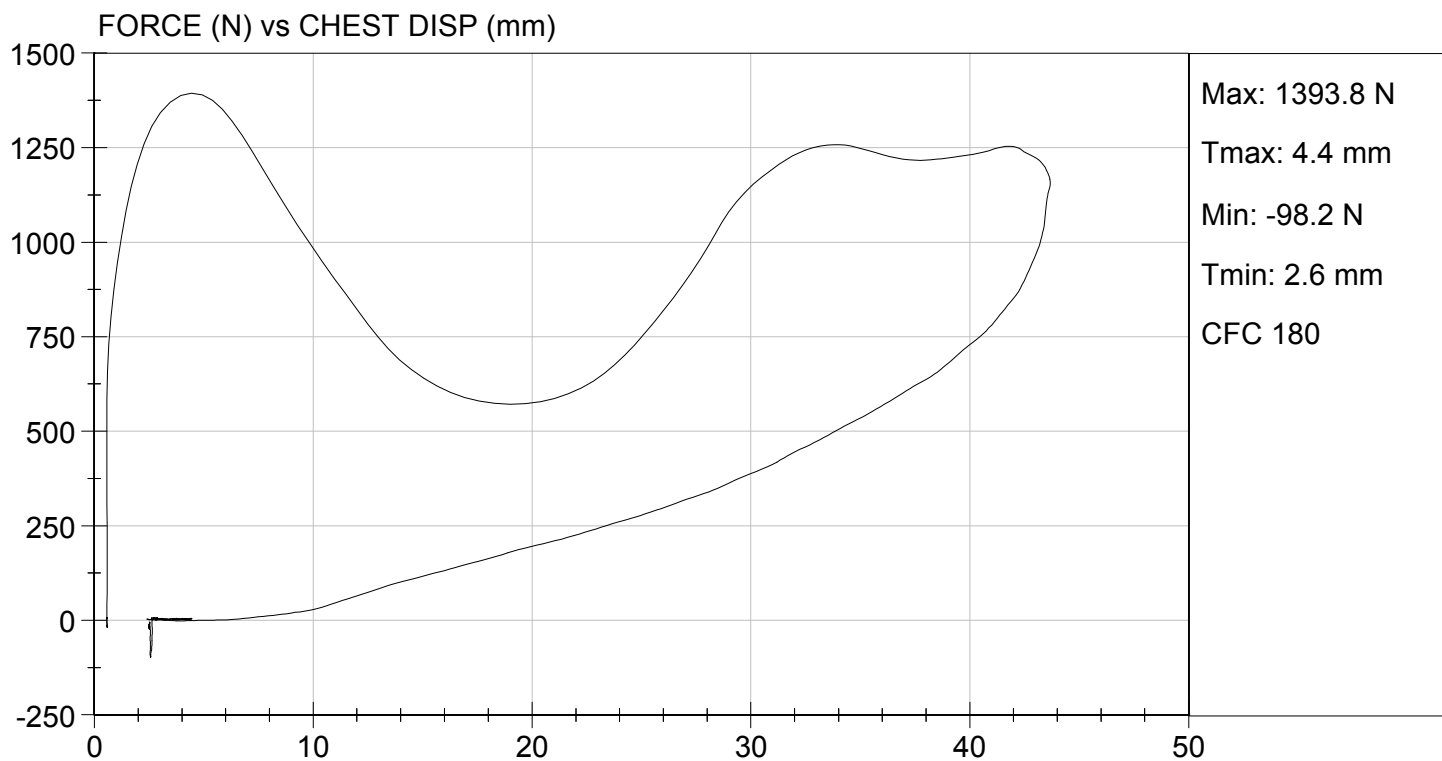
07/09/2014  
Test Date

  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 07/09/2014  
TEST #: D142414



**DATA SHEET C7**  
**TORSO FLEXION TEST (572.125) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: Joseph Radke

X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))  
X N/A, ONLY one torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 11C.
- X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).  
X with legs below the femurs.  
     without legs below the femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
- X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
- X 7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
- X 8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
- X 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

- X   10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))  
Record reference plane angle (max. allowed 22°) See Result Table
- X   11. Attach the pull cable and the load cell. (572.125(c)(6))
- X   12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))
- X   13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
- X   14. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))
- X   15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))
- X   16. Complete the following table:

Torso Flexion Results (572.125(b)), (572.125(c)(7)), (572.125(c)(8))

| Parameter                | Specification                 | Result |
|--------------------------|-------------------------------|--------|
| Initial ref. plane angle | Angle ≤ 22°                   | 14°    |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 1.2°/s |
| Force at 45° ± 0.5°      | 147 N ≤ force ≤ 200 N         | 158 N  |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 15°    |

Joseph Radke  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D142417

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 44     | Pass      |
| Initial Angle                | deg   | 0 to 22       | 14     | Pass      |
| Return Angle                 | deg   | +/- 8         | 15     | Pass      |
| Force at 45 deg              | N     | 147 to 200    | 158    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 1.2    | Pass      |
| Overall Result               |       |               | Pass   |           |

Joseph Radke  
Laboratory Technician

07/09/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET C8**  
**LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: Joseph Radke

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.07 m/s |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     | 2148 N   |

\*Force = impactor mass x deceleration (572.126(b))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Joseph Radke  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

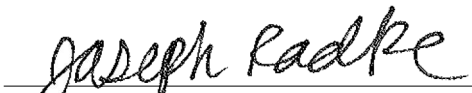
**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

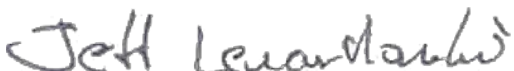
**ATD Serial No:** 155

**Test I.D:** D142416

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 20.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 45     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.07   | Pass      |
| Maximum Force                | N     | 2000 to 3000  | 2148   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

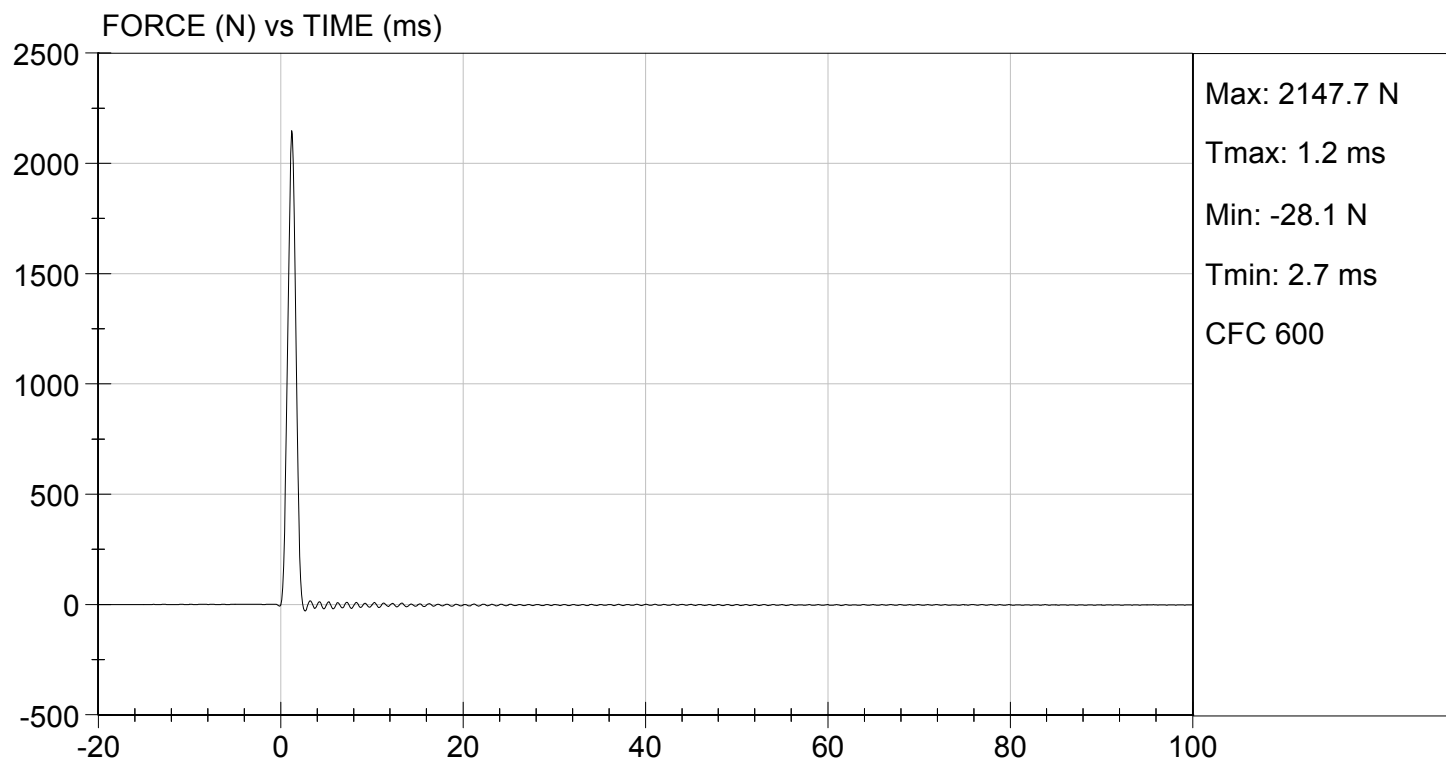
07/09/2014  
Test Date

  
Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.80 ft/s, 2.07 m/s

TEST DATE: 07/09/2014  
TEST #: D142416



**DATA SHEET C9**  
**RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/09/2014

Technician: Joseph Radke

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.07 m/s |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     | 2302 N   |

\*Force = impactor mass x deceleration (572.126(b))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

Joseph Radtke  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

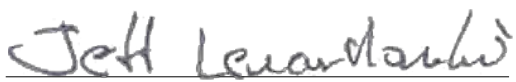
**ATD Serial No:** 155

**Test I.D:** D142415

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 20.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 45     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.07   | Pass      |
| Maximum Force                | N     | 2000 to 3000  | 2302   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

  
Laboratory Technician

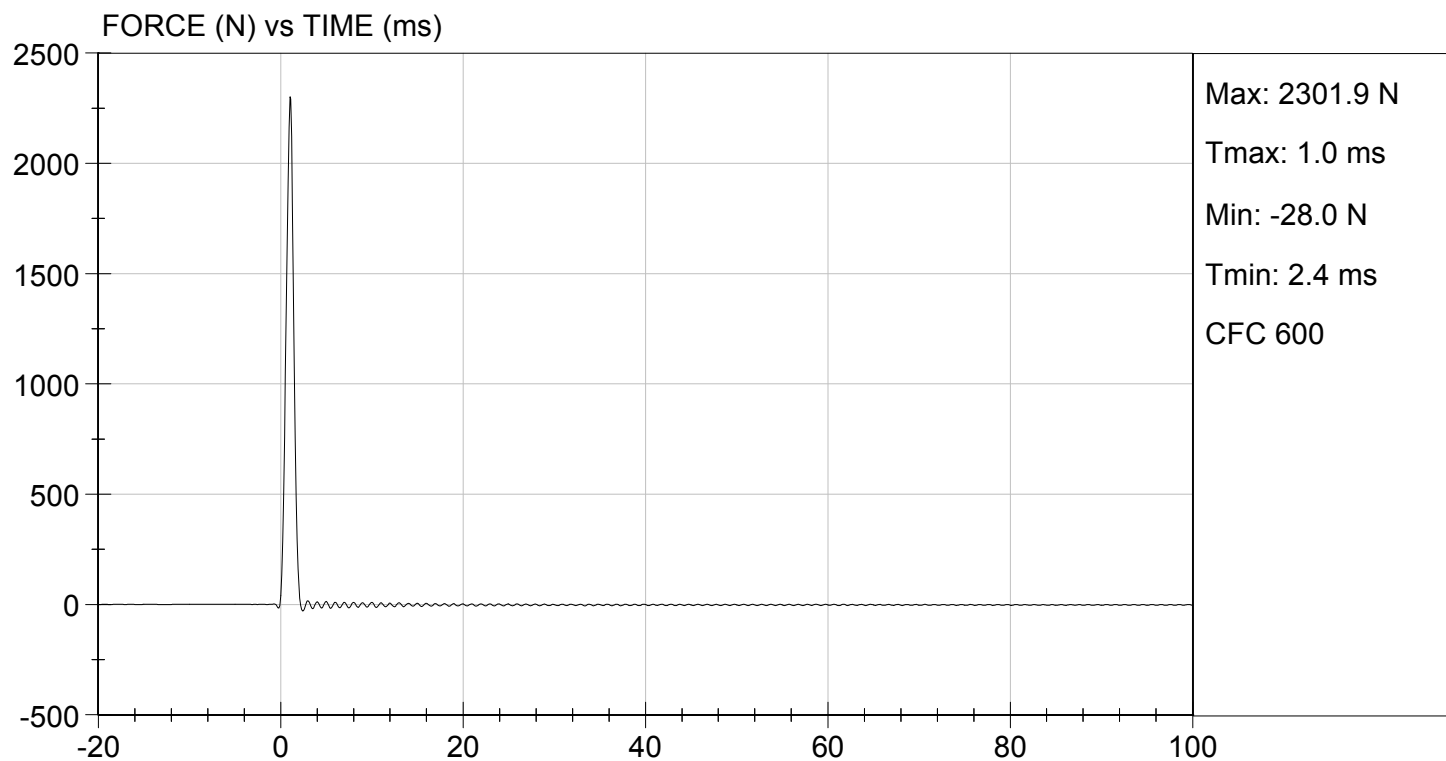
07/09/2014  
Test Date

  
Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.80 ft/s, 2.07 m/s

TEST DATE: 07/09/2014  
TEST #: D142415



# DATA SHEET C10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78783     | 01/24/2014               | 07/24/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78789     | 01/24/2014               | 07/24/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78796     | 01/24/2014               | 07/24/2014               |
| NECK TRANSDUCER                       | Denton       | 1716A               | 1145       | 04/11/2014               | 10/11/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P77617     | 01/24/2014               | 07/24/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P77618     | 01/24/2014               | 07/24/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P77620     | 01/24/2014               | 07/24/2014               |
| CHEST POTENTIOMETER                   | Servo        | 08C1-3179           | 155        | 01/28/2014               | 07/28/2014               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| (2) LEFT FEMUR                        | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AH467      | 2/20/2014                | 8/20/2014                |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 5/1/2014                 | 11/1/2014                |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P77579     | 1/10/2014                | 7/10/2014                |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 4/15/2014                | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 4/15/2014                | 10/15/2014               |

LABORATORY TECHNICIAN:

*Jessica Hall*

**DATA SHEET C3**  
**HEAD DROP TEST (572.122) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: Maxime Chamberland

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive head drop tests are necessary)

- X  1. It has been at least 2 hours since the last head drop. (572.122(c)(5))  
      X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- X  3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- X  4. Accelerometers and their respective mounts are smooth and clean.
- X  5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- X  7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X  9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

- X   10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface.

Record the actual distance: 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X   11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

- X   12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2155.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 33.8 micro inches

- X   13. The impact surface is rigidly supported. (572.122(c)(4))

- X   14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

- X   15. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm$  0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

- X   16. Complete the following table using channel class 1000 data. (572.122(b)):

| Parameter                           | Specification                                    | Result  |
|-------------------------------------|--------------------------------------------------|---------|
| Peak resultant acceleration         | $245 \text{ g} \leq x \leq 300 \text{ g}$        | 285 g   |
| Resultant versus time history curve | Unimodal                                         | Yes     |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes     |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -14.9 g |

- X   17. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Maxime Chamberland  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test ID:** D143181

| Tested Parameter             | Units | Specification      | Result               | Pass/Fail |
|------------------------------|-------|--------------------|----------------------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.6                 | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 43                   | Pass      |
| Peak Resultant Acceleration  | G's   | 245 to 300         | 285                  | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -14.9                | Pass      |
| Unimodal                     | N/A   | Yes                | Yes                  | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes                  | Pass      |
|                              |       |                    | Overall Test Results | Pass      |

Maxime Chamberland

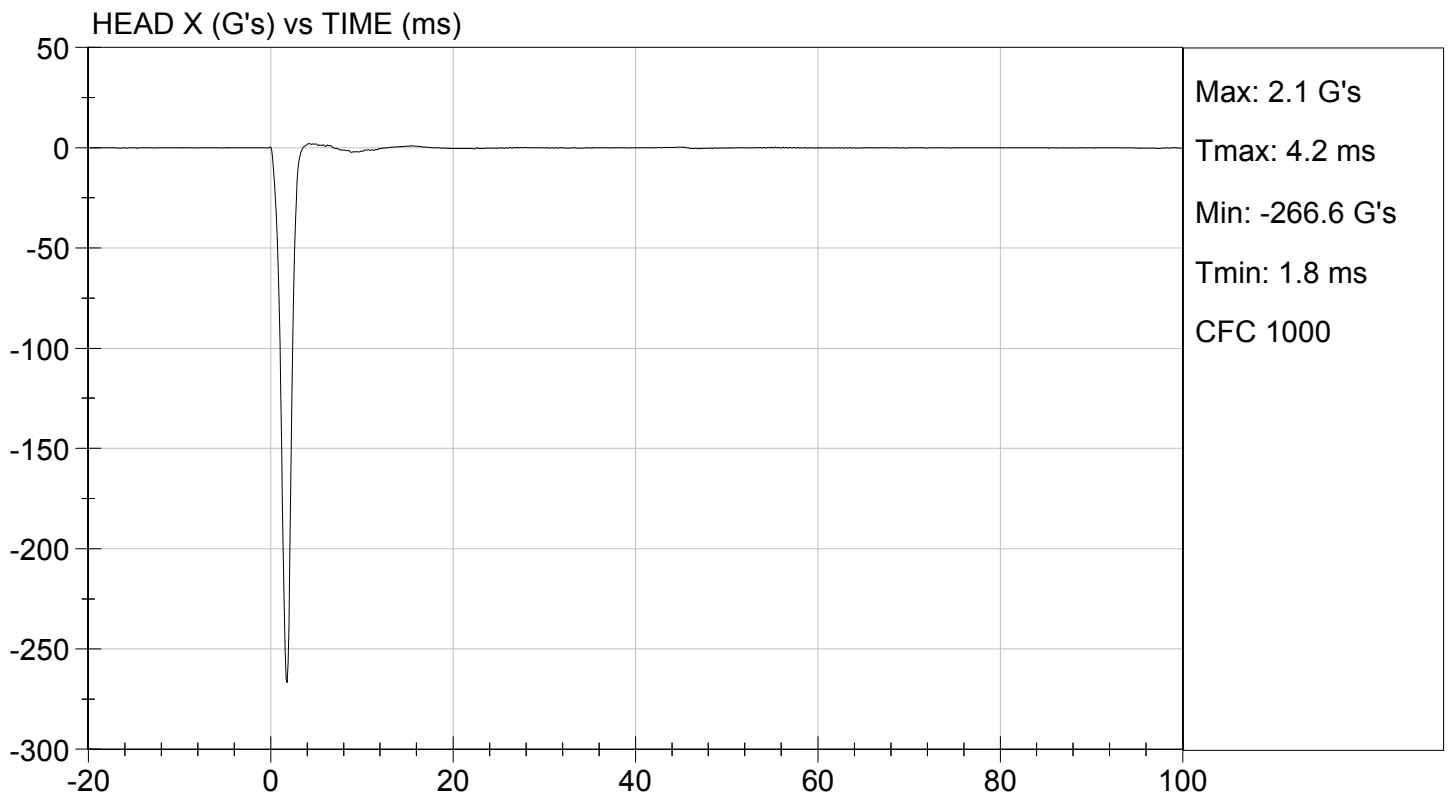
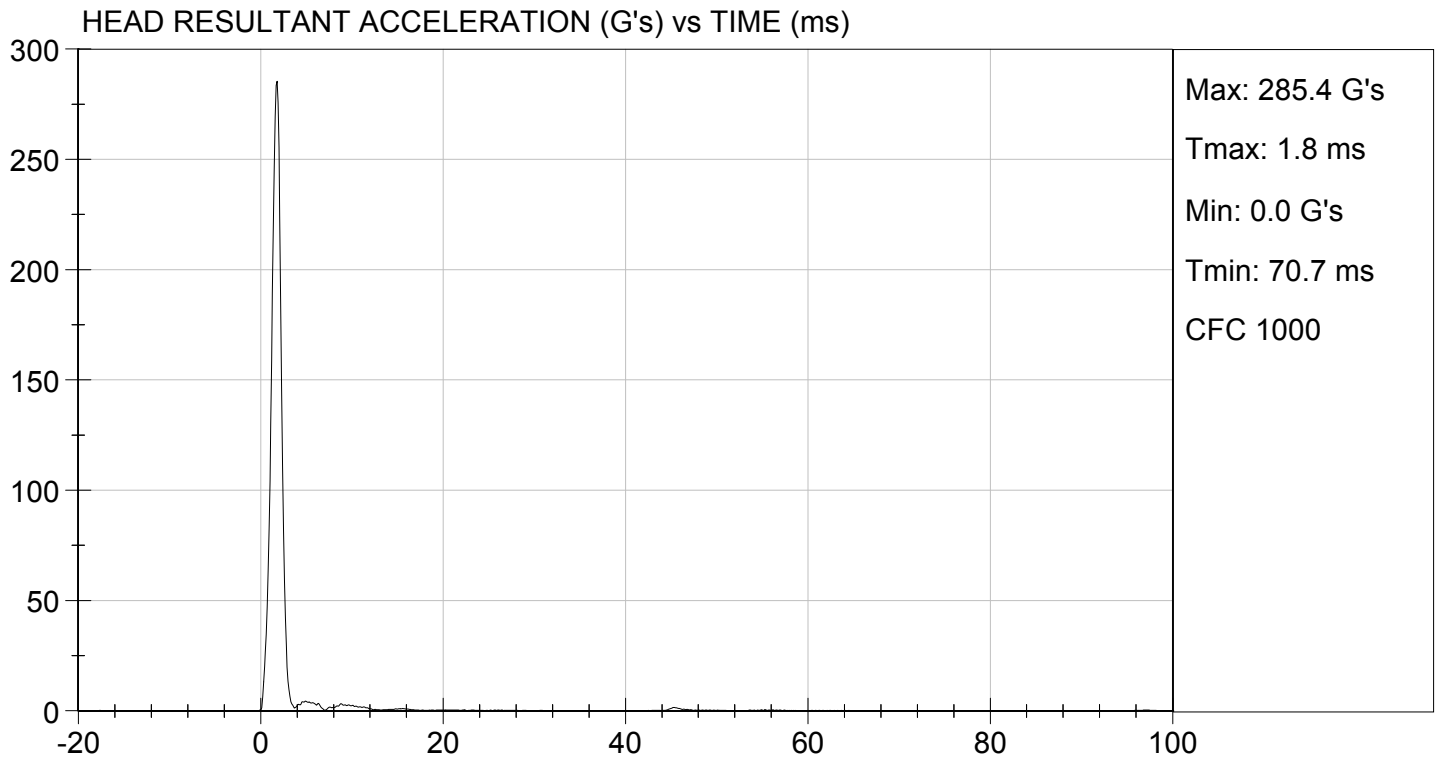
Laboratory Technician

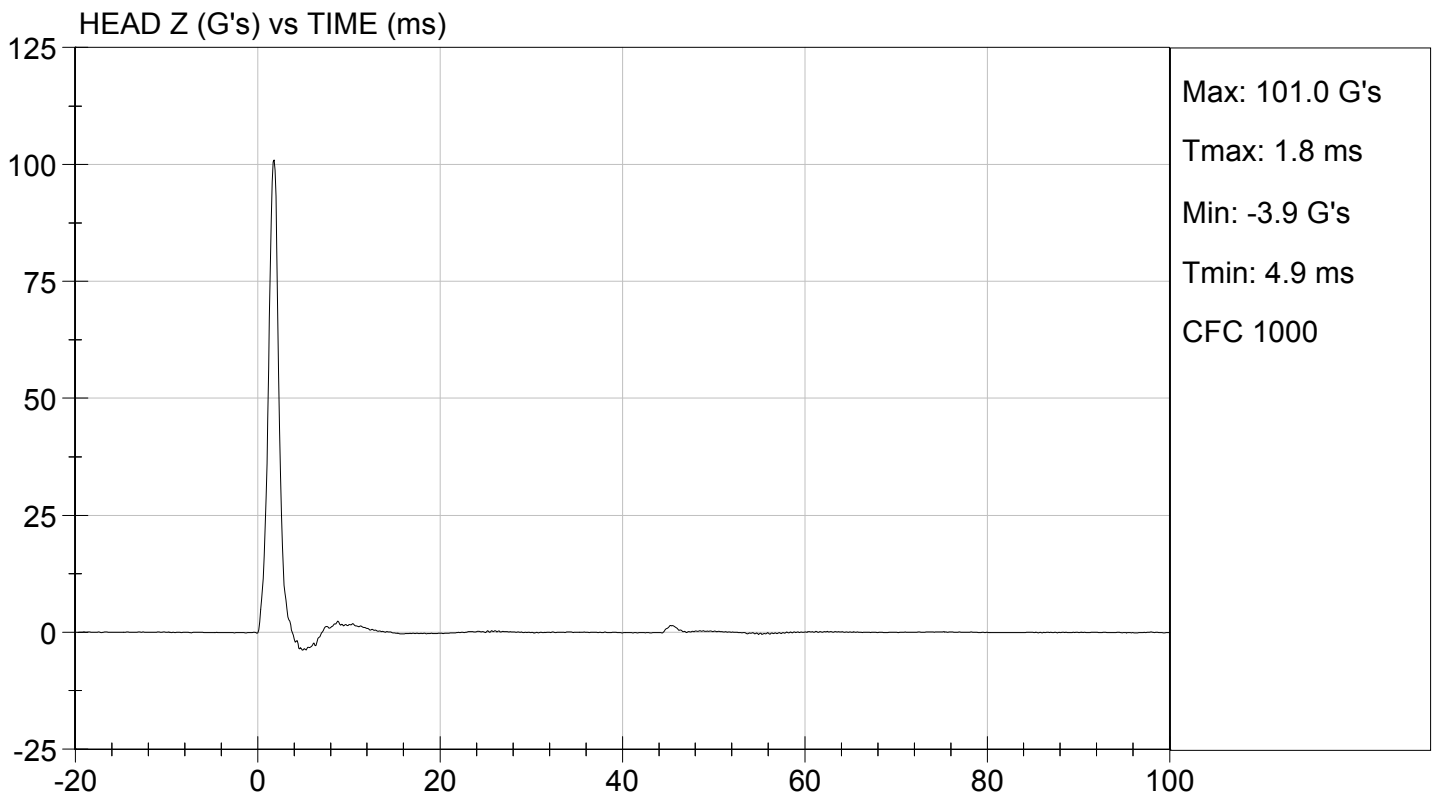
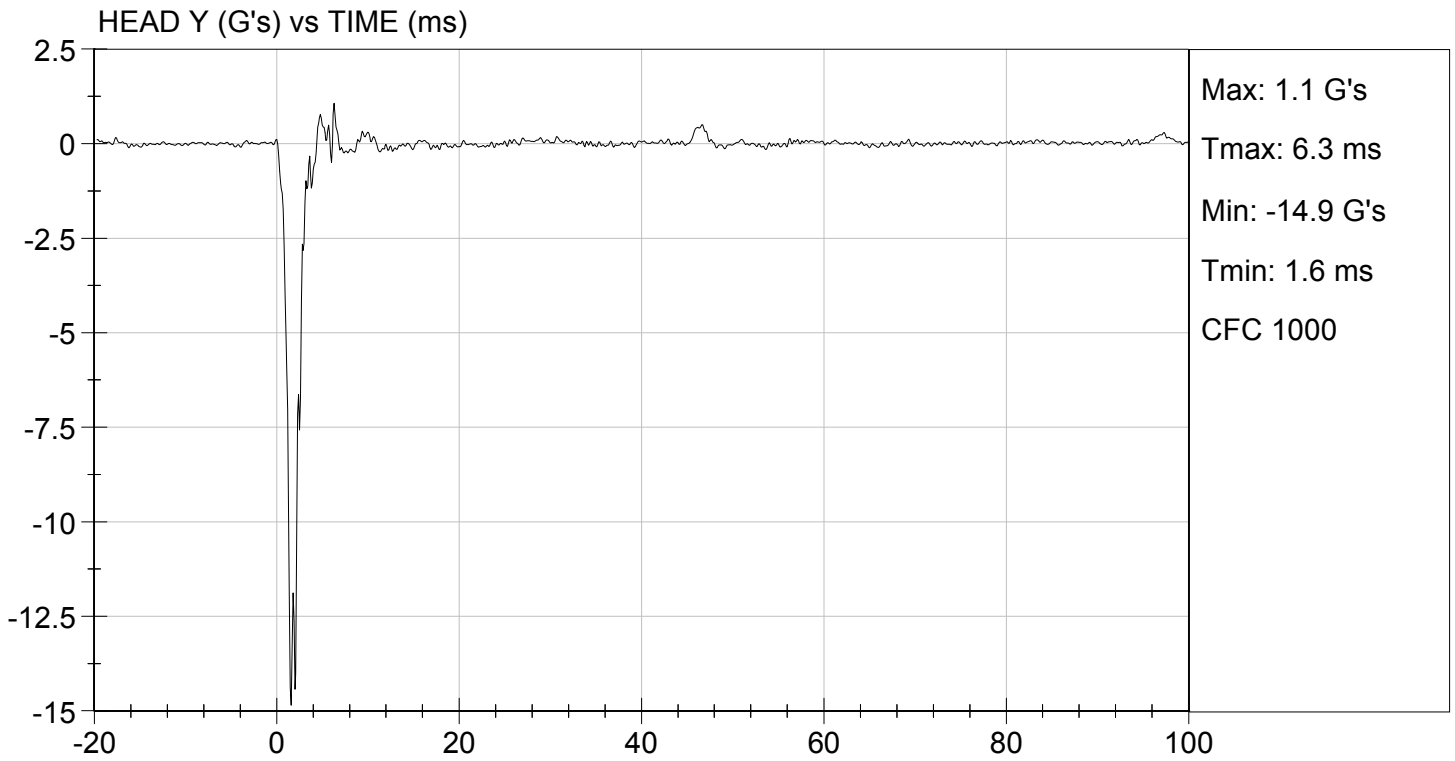
09/12/2014

Test Date

Jeff Levanowski

Approved By





**DATA SHEET C4**  
**NECK FLEXION TEST (572.123) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive flexion tests are necessary)

- X  1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 X  N/A, ONLY one neck test performed
- X  2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X  3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X  5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
- X  6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- X  7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

- X   8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))
- X   9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123I(3))
- X   10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X   11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123I(4)(i))
- X   12. Complete the following table:

Neck Flexion Test Results (572.123(b)(1)) & (572.123(c)(4)(I & ii))

| Parameter                                        |         | Specification                                                                                                                                        | Result             |
|--------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| Pendulum impact speed                            |         | $4.83 \text{ m/s} \leq \text{speed} \leq 5.07 \text{ m/s}$                                                                                           | 4.98 m/s           |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.2 \text{ m/s} \leq \Delta V \leq 1.6 \text{ m/s}$                                                                                                 | 1.4 m/s            |
|                                                  | @ 20 ms | $2.4 \text{ m/s} \leq \Delta V \leq 3.4 \text{ m/s}$                                                                                                 | 2.8 m/s            |
|                                                  | @ 30 ms | $3.8 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$                                                                                                 | 3.8 m/s            |
| Plane D Rotation                                 |         | Peak moment*<br>$27 \text{ Nm} \leq \text{moment} \leq 33 \text{ Nm}$ during the following rotation range $74^\circ \leq \text{angle} \leq 92^\circ$ | 32 Nm @ 77 degrees |
| Positive Moment Decay** (Flexion)                |         | Time to decay to 5 Nm $103 \text{ ms} \leq \text{time} \leq 123 \text{ ms}$                                                                          | 107 ms             |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(1)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- X   13. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST  
HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143182

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 46     | Pass      |
| Pendulum Speed                                      |       | m/s   | 4.83 to 5.07  | 4.98   | Pass      |
| Pendulum Velocity                                   | 10 ms | m/s   | 1.2 to 1.6    | 1.4    | Pass      |
|                                                     | 20 ms | m/s   | 2.4 to 3.4    | 2.8    | Pass      |
|                                                     | 30 ms | m/s   | 3.8 to 5.0    | 3.8    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 74 to 92      | 77     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | 27 to 33      | 32     | Pass      |
| Positive Moment Time Curve Decay to 5 Nm            |       | ms    | 103 to 123    | 107    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

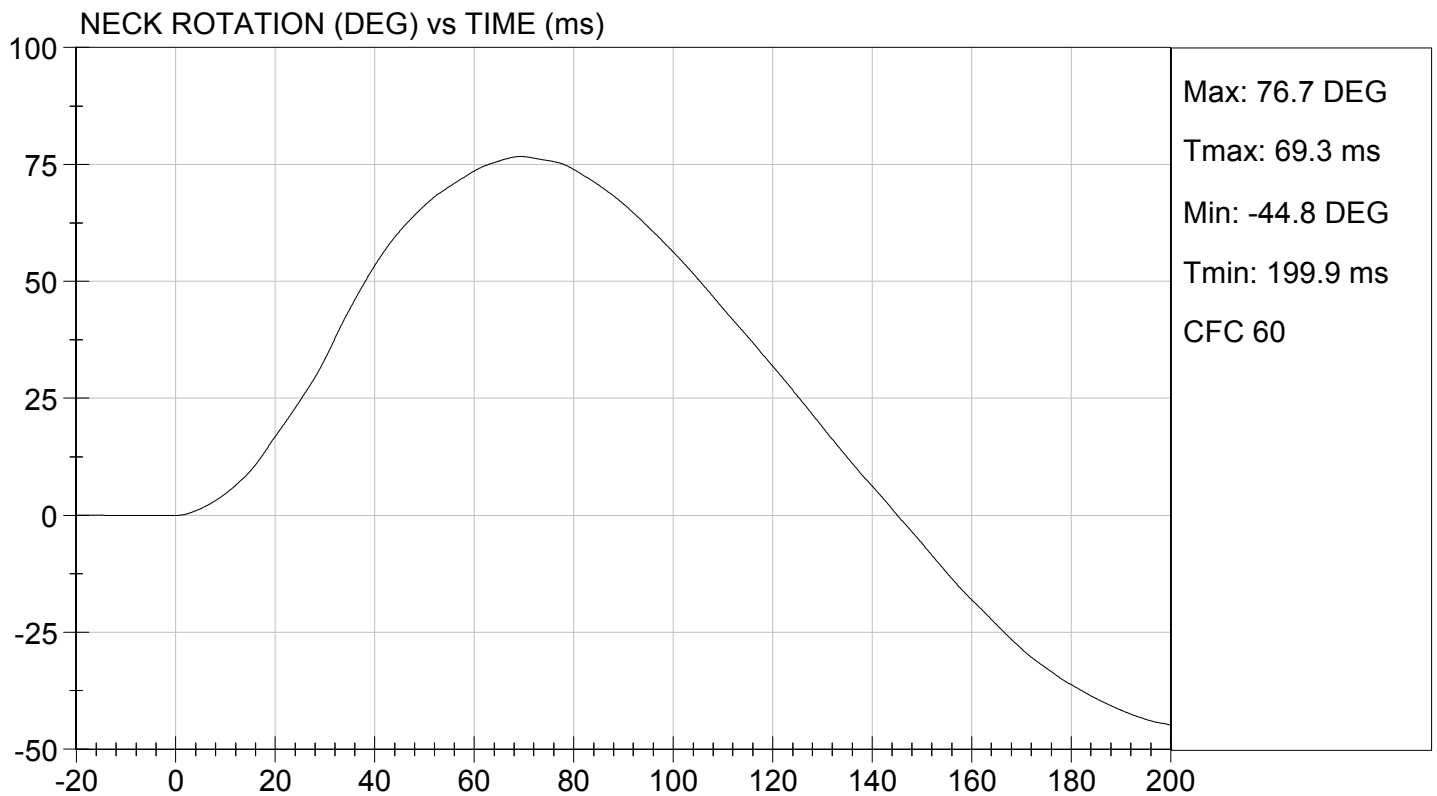
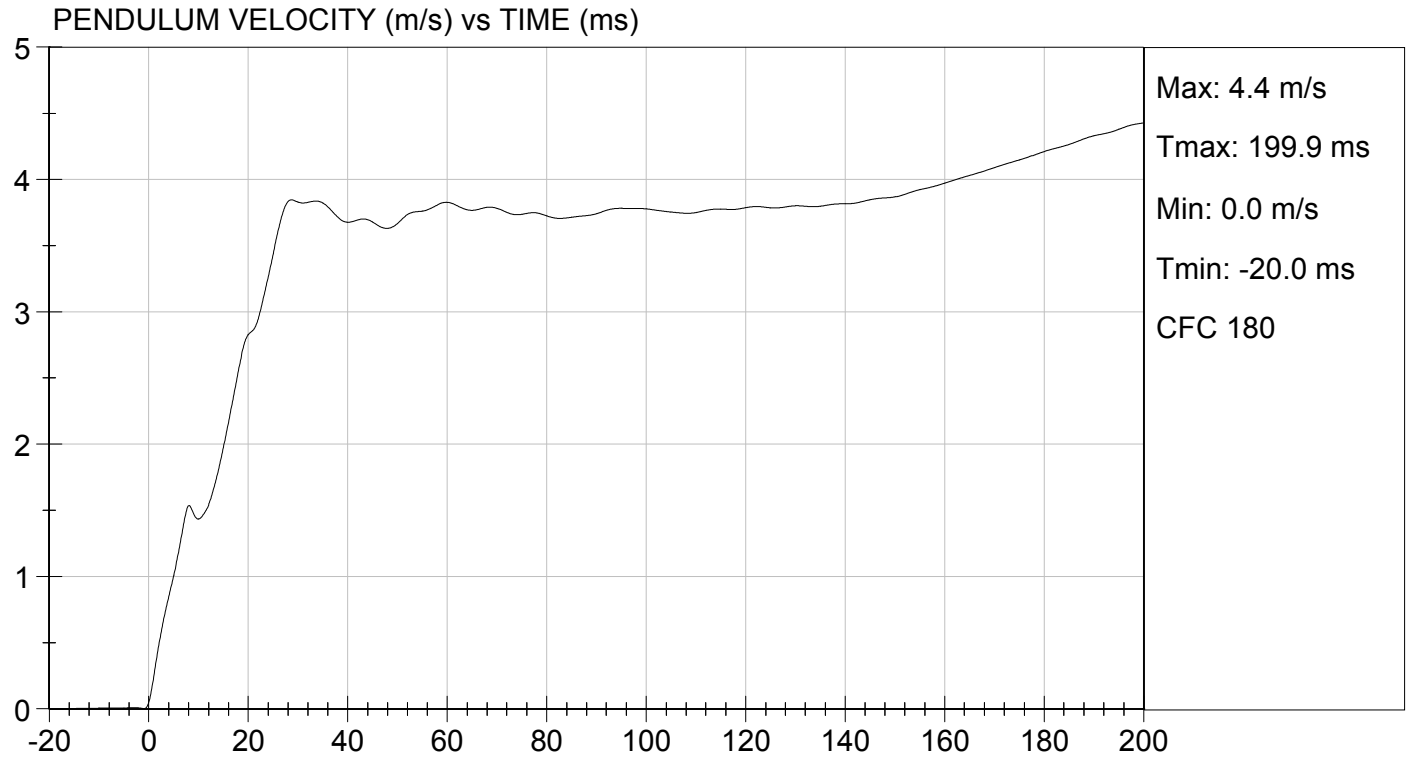
09/12/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 16.34 ft/s, 4.98 m/s

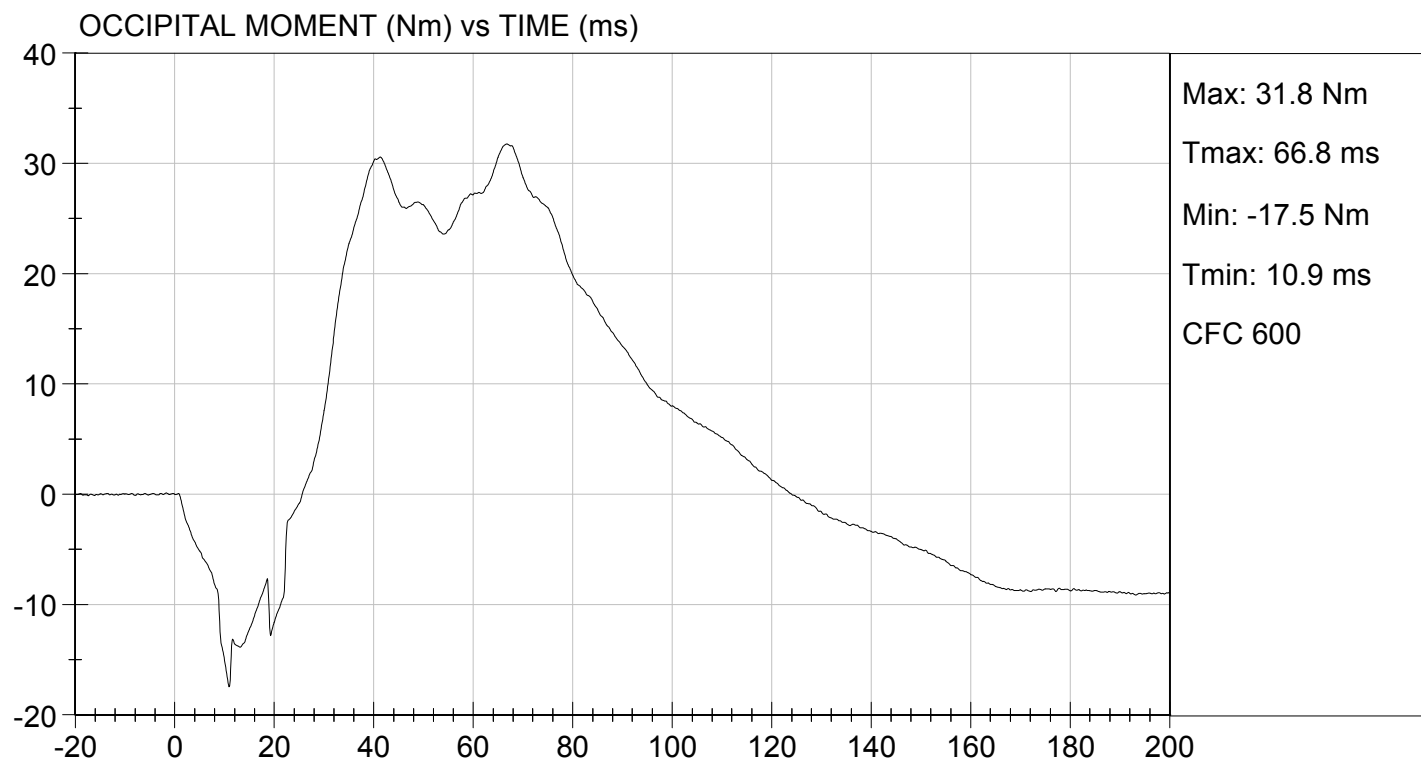
TEST DATE: 09/12/2014  
TEST #: D143182





TEST DESC: NECK FLEXION  
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 09/12/2014  
TEST #: D143182



**DATA SHEET C5**  
**NECK EXTENSION TEST (572.123) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

- Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
    X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage

- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to  $0.23 \pm 0.02$  Nm ( $2.0 \pm 0.2$  in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.123(b)(2)) & (572.123(c)(4)(i & ii))

| Parameter                                        |         | Specification                                                                                                                                           | Result              |
|--------------------------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Pendulum impact speed                            |         | $4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$                                                                                              | 4.42 m/s            |
| Pendulum $\Delta V$ with respect to impact speed | @ 10 ms | $1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$                                                                                                    | 1.2 m/s             |
|                                                  | @ 20 ms | $2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$                                                                                                    | 2.3 m/s             |
|                                                  | @ 30 ms | $3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$                                                                                                    | 3.3 m/s             |
| Plane D Rotation                                 |         | Peak moment*<br>$-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq \text{angle} \leq 103^\circ$ | -20 Nm @ 86 degrees |
| Negative Moment Decay** (Extension)              |         | Time to decay to -5 Nm $123 \text{ ms} \leq \text{time} \leq 147 \text{ ms}$                                                                            | 135 ms              |

\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$  (572.123(b)(2)(iii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

- X 14. Plots of acceleration, velocity, y-axis moment, and x-axis force and y-axis moment about the occipital condyle follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143183

| Tested Parameter                                    |       | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                              |       | deg C | 20.6 to 22.2  | 21.3   | Pass      |
| Laboratory Relative Humidity                        |       | %     | 10 to 70      | 46     | Pass      |
| Pendulum Speed                                      |       | m/s   | 4.18 to 4.42  | 4.42   | Pass      |
| Pendulum Velocity                                   | 10 ms | m/s   | 1.0 to 1.4    | 1.2    | Pass      |
|                                                     | 20 ms | m/s   | 2.2 to 3.0    | 2.3    | Pass      |
|                                                     | 30 ms | m/s   | 3.2 to 4.2    | 3.3    | Pass      |
| D Plane Rotation                                    | Max   | deg   | 85 to 103     | 86     | Pass      |
| Occipital Condyle Moment within Deflection Corridor |       | Nm    | -19 to -24    | -20    | Pass      |
| Positive Moment Time Curve Decay to 5 Nm            |       | msec  | 123 to 147    | 135    | Pass      |
| Overall Results                                     |       |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

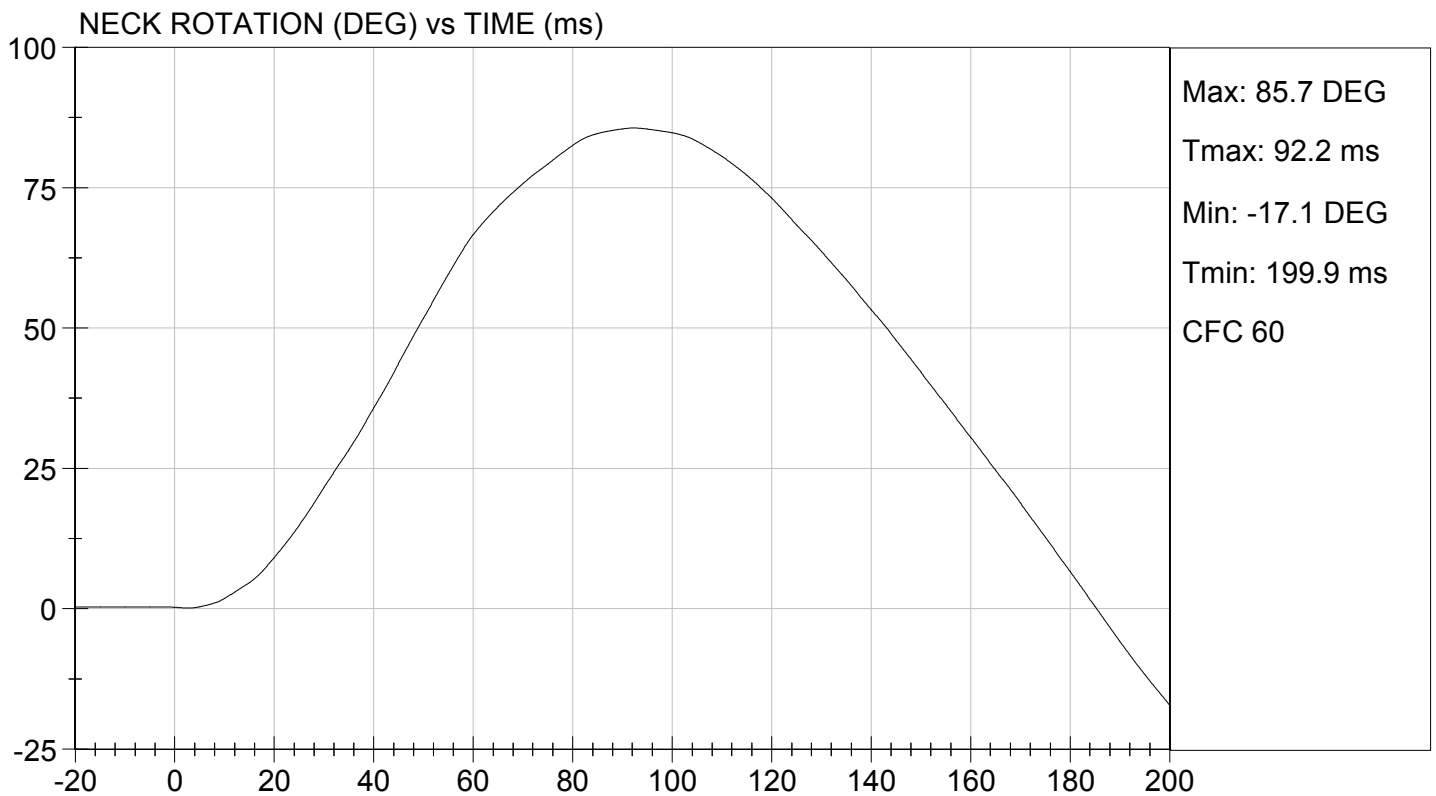
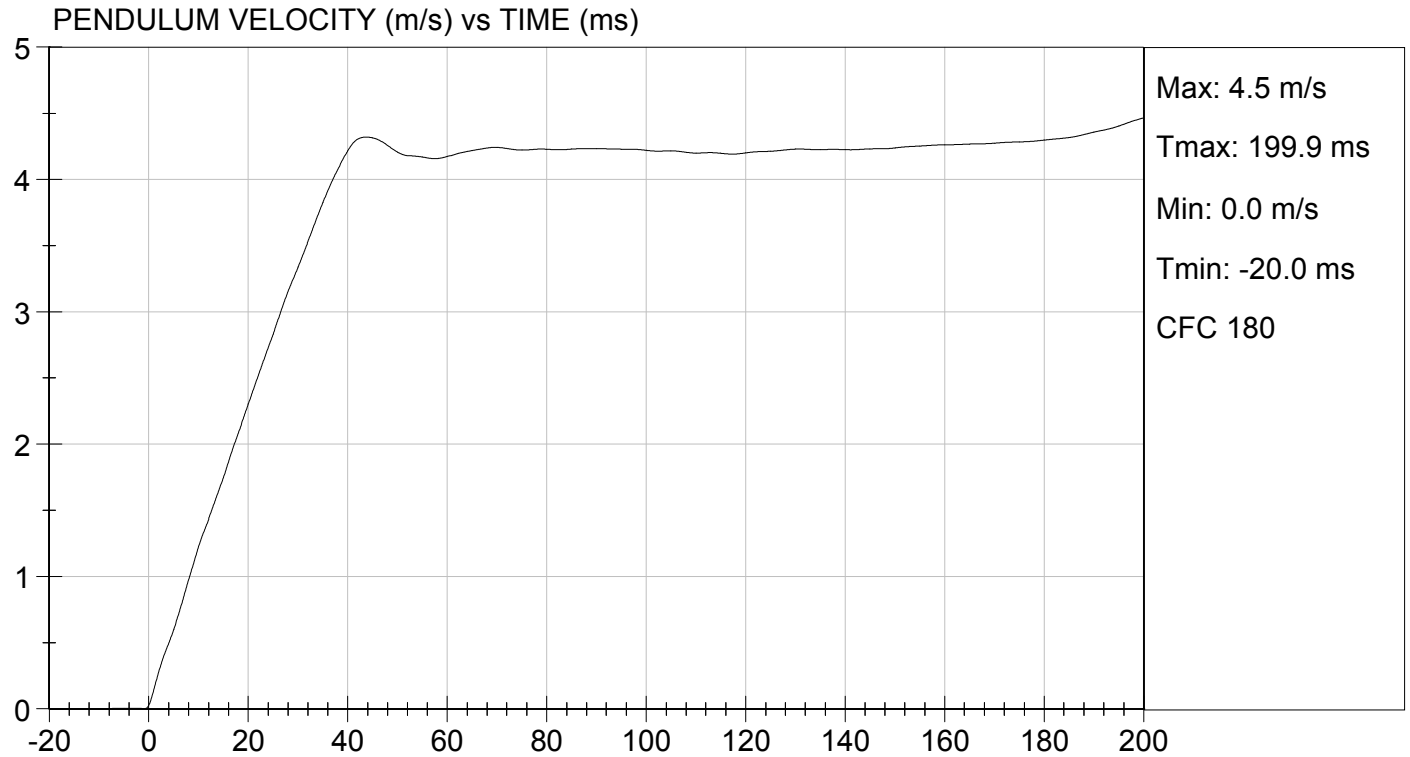
09/12/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: NECK EXTENSION  
VELOCITY: 14.50 ft/s, 4.42 m/s

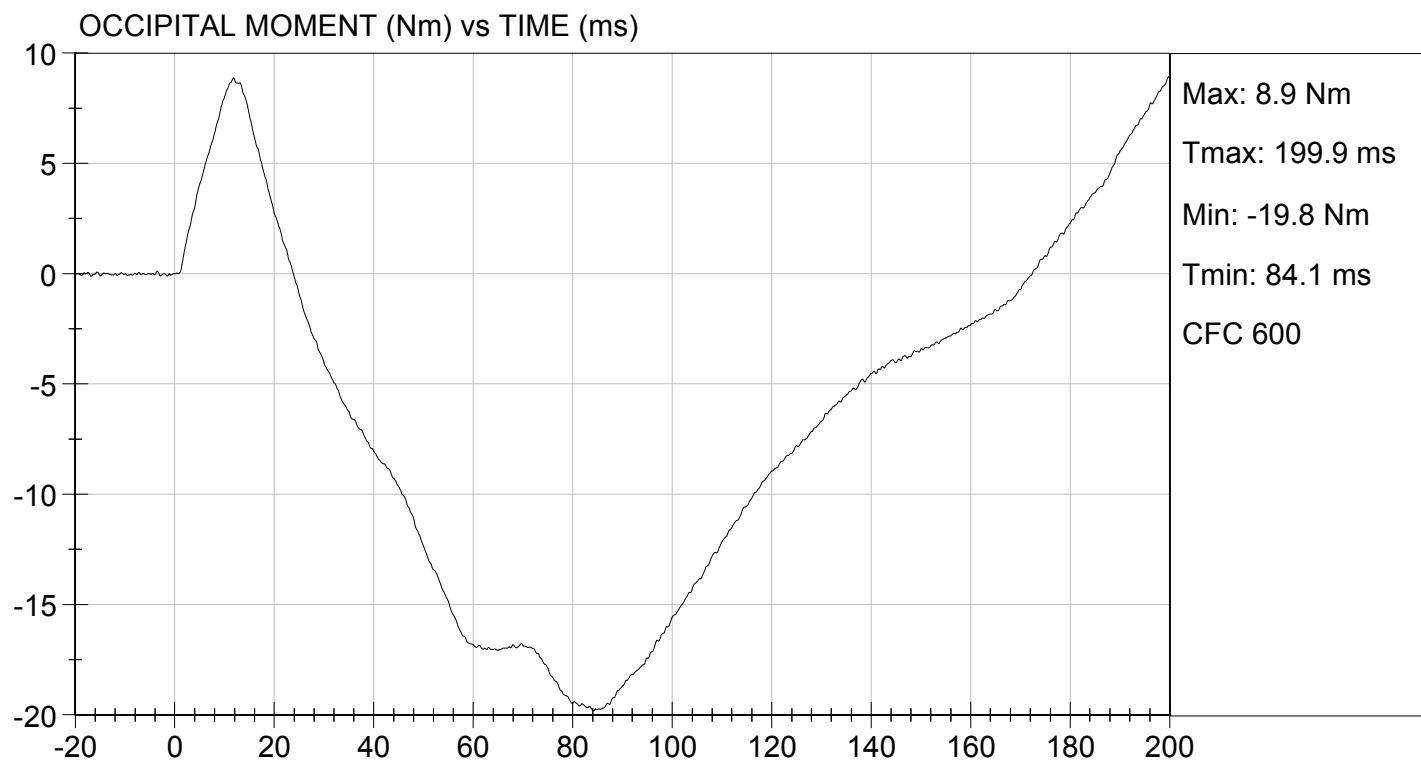
TEST DATE: 09/12/2014  
TEST #: D143183





TEST DESC: NECK EXTENSION  
VELOCITY: 14.50 ft/s, 4.42 m/s

TEST DATE: 09/12/2014  
TEST #: D143183



**DATA SHEET C6**  
**THORAX IMPACT TEST (572.124) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

X  1. It has been at least 30 minutes since the last thorax impact test. (572.127(o))  
 X  N/A, ONLY one thorax impact test performed

X  2. The test fixture conforms to the specifications in Figure 11C.

X  3. The complete assembled dummy (127-0000) is used (572.124(b)).

X  4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(1))

|                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |

X  5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

Record findings and actions:

X  - No damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.

     - The following repairs or replacement was performed. Record damage.

X  6. The dummy is dressed in a size 4 pair of long pants having a weight of less than 0.090 kg (0.2 lb) with the legs cut off sufficiently above the knee to allow the knee target to be visible. (572.124(c)(2))

- X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))
- X 8. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $8^\circ \pm 2^\circ$ . The angle may be measured at the pelvis lumbar joining surface.
- X 9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.124(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X 14. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

| Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2)) |                                                                |          |
|-----------------------------------------------------------|----------------------------------------------------------------|----------|
| Parameter*                                                | Specification                                                  | Result   |
| Test Probe Speed                                          | $6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$     | 6.77 m/s |
| Chest Compression                                         | $38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$ | 43.9 mm  |
| Peak force** between 38.0 and 46.0 mm chest compression   | $1150\text{N} \leq \text{peak force} \leq 1380\text{N}$        | 1209 N   |
| Peak force** between 12.5 and 38.0 mm chest compression   | Peak force $\leq 1500 \text{ N}$                               | 1243 N   |
| Internal Hysteresis***                                    | $65\% \leq \text{hysteresis} \leq 85\%$                        | 70%      |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

X 18. Plots of chest compression, acceleration, force, force versus deflection follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**

**THORAX IMPACT**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143184

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Temperature                                   | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Relative Humidity                             | %     | 10 to 70      | 43     | Pass      |
| Probe Speed                                   | m/s   | 6.59 to 6.83  | 6.77   | Pass      |
| Peak Deflection                               | mm    | 38.0 to 46.0  | 43.9   | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 1150 to 1380  | 1,209  | Pass      |
| Internal Hysteresis                           | %     | 65 to 85      | 70     | Pass      |
| Peak Force 12.5 mm - 38.0 mm                  | N     | <= 1,500      | 1,243  | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

*David Schoedel*

Laboratory Technician

09/12/2014

Test Date

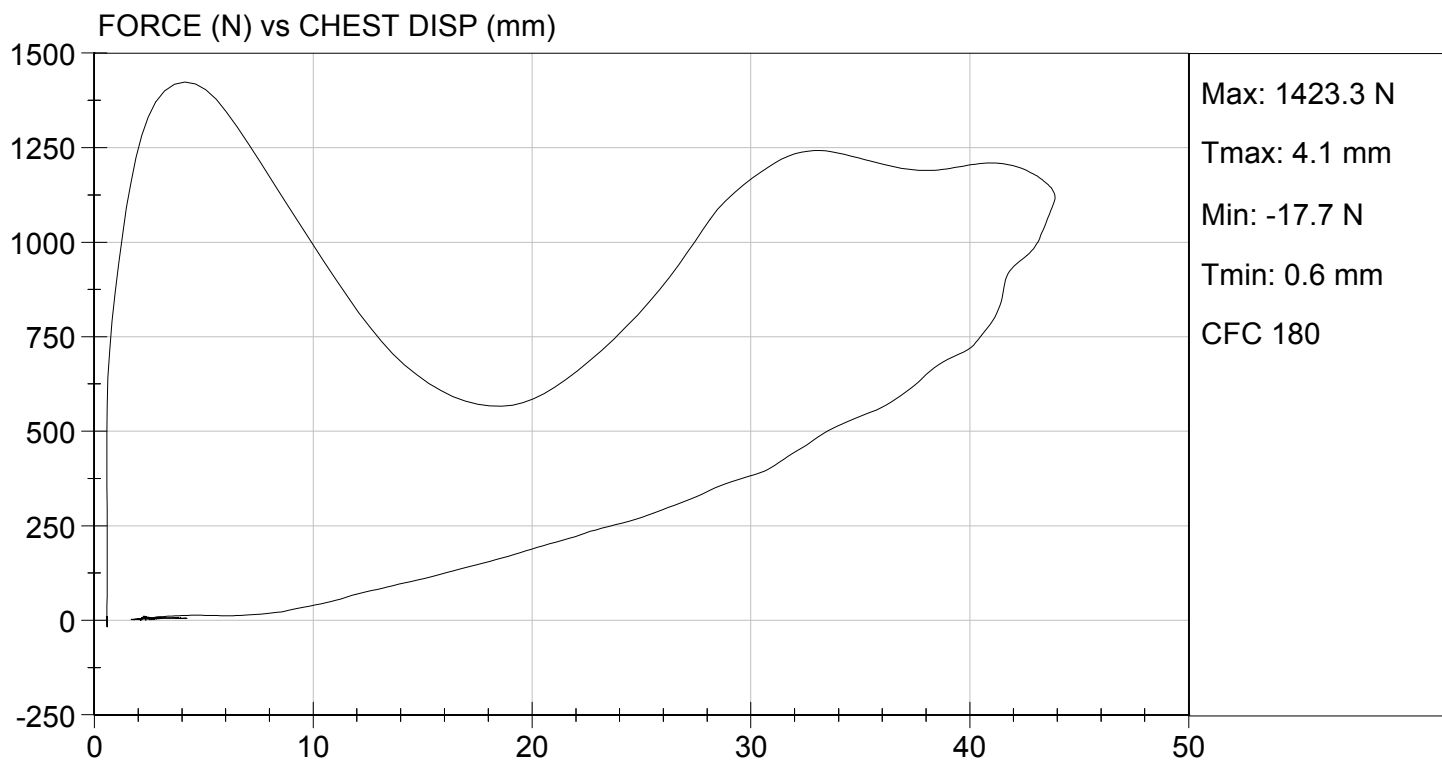
*Jeff Leonard*

Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 09/12/2014  
TEST #: D143184



**DATA SHEET C7**  
**TORSO FLEXION TEST (572.125) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- X  1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))  
 X  N/A, ONLY one torso flexion test performed
- X  2. The test fixture conforms to the specifications in Figure 11C.
- X  3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).  
 X  with legs below the femurs.  
     without legs below the femurs.
- X  4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
- X  6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
- X  7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
- X  8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
- X  9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

- X   10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))  
           Record reference plane angle (max. allowed 22°)           See Result Table
- X   11. Attach the pull cable and the load cell. (572.125(c)(6))
- X   12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))
- X   13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
- X   14. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))
- X   15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))
- X   16. Complete the following table:

Torso Flexion Results (572.125(b)), (572.125(c)(7)), (572.125(c)(8))

| Parameter                | Specification                 | Result |
|--------------------------|-------------------------------|--------|
| Initial ref. plane angle | Angle ≤ 22°                   | 13°    |
| Torso rotation rate      | 0.5°/s ≤ rate ≤ 1.5°/s        | 1.2°/s |
| Force at 45° ± 0.5°      | 147 N ≤ force ≤ 200 N         | 155 N  |
| Final ref. plane angle   | Initial ref. plane angle ± 8° | 11°    |

David Schoedel  
 Signature

09/12/2014  
 Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143187

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.6   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 43     | Pass      |
| Initial Angle                | deg   | 0 to 22       | 13     | Pass      |
| Return Angle                 | deg   | +/- 8         | 11     | Pass      |
| Force at 45 deg              | N     | 147 to 200    | 155    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 1.2    | Pass      |
| Overall Result               |       |               | Pass   |           |

David Schoedel  
Laboratory Technician

09/12/2014

Test Date

Jeff Leonard  
Approved By

**DATA SHEET C8**  
**LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X  1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 X  N/A, ONLY one knee impact test performed
- X  2. The test fixture conforms to the specifications in Figure 12C.
- X  3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X  4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X  6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X  7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X  8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X  9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.13 m/s |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     | 2127 N   |

\*Force = impactor mass x deceleration (572.126(b))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

David Schoedel

Signature

09/12/2014

Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143186

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.13   | Pass      |
| Maximum Force                | N     | 2000 to 3000  | 2127   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

*David Schoedel*

Laboratory Technician

09/12/2014

Test Date

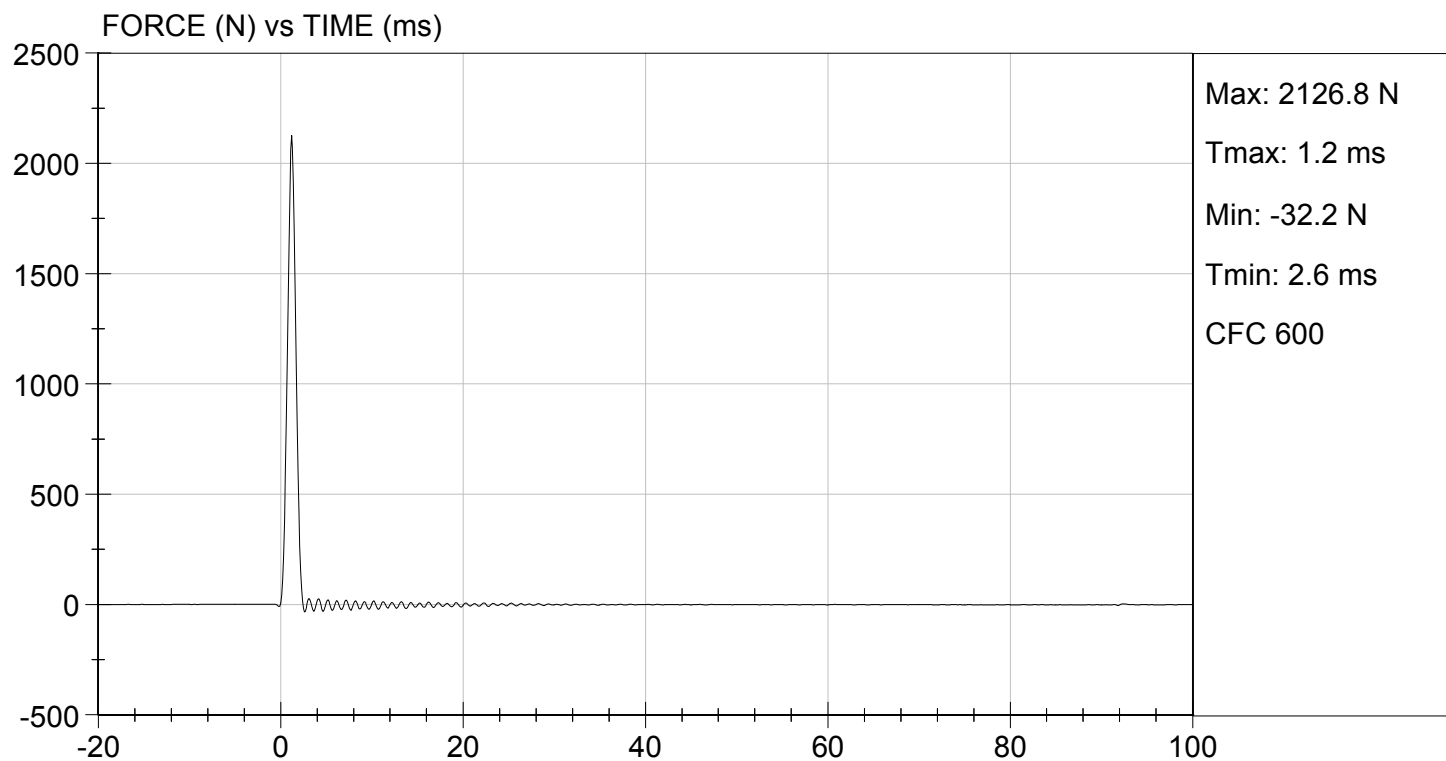
*Jeff Leonard*

Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 09/12/2014  
TEST #: D143186



**DATA SHEET C9**  
**RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive knee impact tests are necessary)

- X  1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 X  N/A, ONLY one knee impact test performed
- X  2. The test fixture conforms to the specifications in Figure 12C.
- X  3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X  4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>46%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X  6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X  7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X  8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X  9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

X   10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.  
(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other  
attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

  X   11. Complete the following table:

Knee Impact Results (572.126(b)(1)) & (572.126(c)(5))

| Parameter              | Specification                                              | Result   |
|------------------------|------------------------------------------------------------|----------|
| Probe speed            | $2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$ | 2.11 m/s |
| Peak resistance force* | $2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$     | 2386 N   |

\*Force = impactor mass x deceleration (572.126(b))

  X   12. Plots of acceleration versus time and force versus time follow this sheet.

*David Schoedel*

Signature

09/12/2014

Date

**MGA RESEARCH CORPORATION**

**RIGHT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D143185

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.5  | 21.3   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 46     | Pass      |
| Probe Speed                  | m/s   | 2.07 to 2.13  | 2.11   | Pass      |
| Maximum Force                | N     | 2000 to 3000  | 2386   | Pass      |
| Overall Test Results         |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

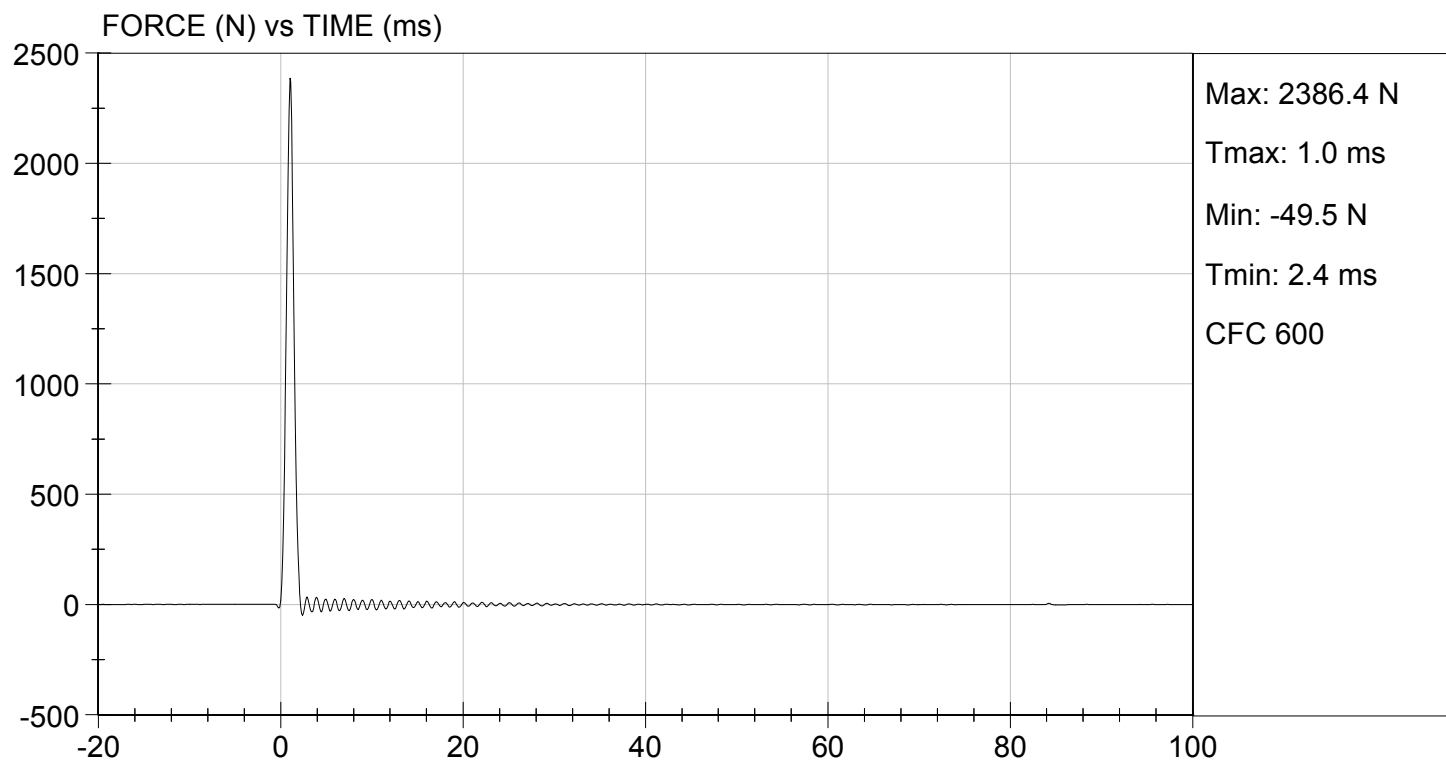
09/12/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: RIGHT KNEE  
VELOCITY: 6.92 ft/s, 2.11 m/s

TEST DATE: 09/12/2014  
TEST #: D143185



# DATA SHEET C10

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78692     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78776     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79751     | 07/02/2014               | 01/02/2015               |
| NECK TRANSDUCER                       | Denton       | 1716A               | 1145       | 04/11/2014               | 10/11/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78983     | 07/02/2014               | 01/02/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78984     | 07/02/2014               | 01/02/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P78986     | 07/02/2014               | 01/02/2015               |
| CHEST POTENTIOMETER                   | Servo        | 08C1-3179           | 155        | 07/09/2014               | 01/09/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| (2) LEFT FEMUR                        | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2014               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 05/01/2014               | 11/01/2014               |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 155

Test Date: 09/09/2014

Technician: Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damage | OK |
|-----------------------------|--------------------------------------------------------------|----------|--------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |        | X  |
| Head                        | Ballast secure                                               |          |        | X  |
|                             | General appearance                                           |          |        | X  |
| Neck                        | Broken or cracked rubber                                     |          |        | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |        | X  |
|                             | Looseness at the condyle joint                               |          |        | X  |
|                             | Nodding blocks cracked or out of position                    |          |        | X  |
| Spine                       | Broken or cracks in rubber                                   |          |        | X  |
| Ribs                        | Broken or bent ribs                                          |          |        | X  |
|                             | Broken or bent rib supports                                  |          |        | X  |
|                             | Damping material separated or cracked                        |          |        | X  |
|                             | Rubber bumpers in place                                      |          |        | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |        | X  |
|                             | Slider arm riding in track                                   |          |        | X  |
| Transducer leads            | Torn cables                                                  |          |        | X  |
| Accelerometer Mountings     | Head mounting secure                                         |          |        | X  |
|                             | Chest mounting secure                                        |          |        | X  |
| Knees                       | Skin condition                                               |          |        | X  |
|                             | Insert (do not remove)                                       |          |        | X  |
|                             | Casting                                                      |          |        | X  |
| Limbs                       | Normal movement and adjustment                               |          |        | X  |
| Knee Sliders                | Wires intact                                                 |          |        | X  |
|                             | Rubber returned to "at rest" position                        |          |        | X  |
| Pelvis                      | Broken                                                       |          |        | X  |
| Other                       |                                                              |          |        | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

09/12/2014  
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard  
Signature

09/12/2014  
Date

## EXTERNAL DIMENSIONS

| HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS |                                |                                                                                                                                                     |                         |                    |
|--------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                          | DESCRIPTION                    | DETAILS                                                                                                                                             | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| A                                                                  | TOTAL SITTING HEIGHT           | Seat surface to highest point on top of the head.                                                                                                   | 538.5-553.7             | 539.7              |
| B                                                                  | SHOULDER PIVOT HEIGHT          | Centerline of shoulder pivot bolt to the seat surface.                                                                                              | 307.4-322.6             | 316.4              |
| C                                                                  | H-POINT HEIGHT                 | Reference                                                                                                                                           | 34.3-44.5               | 41.2               |
| D                                                                  | H-POINT LOCATION FROM BACKLINE | Reference                                                                                                                                           | 56.9-67.1               | 65.3               |
| E                                                                  | SHOULDER PIVOT FROM BACKLINE   | Center of the shoulder pivot bolt to the fixture's rear vertical surface.                                                                           | 60.9-71.1               | 65.8               |
| F                                                                  | THIGH CLEARANCE                | Fixture's seat surface to highest point on the upper leg segment                                                                                    | 81.0-91.2               | 85.7               |
| G                                                                  | BACK OF ELBOW TO WRIST PIVOT   | Back of the elbow flesh to the finger tip, in line with the elbow and wrist centerlines                                                             | 247.4-262.6             | 251.3              |
| H                                                                  | HEAD BACK TO BACKLINE          | Rearmost surface of the head to the fixture's rear vertical surface (Reference)                                                                     | 48.2-58.4               | 53.1               |
| I                                                                  | SHOULDER TO - ELBOW LENGTH     | Measure from the highest point on top of the shoulder to the lowest part of the flesh on the elbow in line with the shoulder and elbow pivot bolts. | 185.4-200.6             | 199.3              |
| J                                                                  | ELBOW REST HEIGHT              | Measure from the flesh below the elbow pivot bolt to the seat surface.                                                                              | 133.6-148.8             | 141.4              |
| K                                                                  | BUTTOCK TO KNEE LENGTH         | The forward most part of the knee flesh to the fixture's rear vertical surface, in line with the knee and hip pivots.                               | 284.8-300.0             | 288.6              |
| L                                                                  | POPLITEAL HEIGHT               | Seat surface to the horizontal plane of the bottom of the feet.                                                                                     | 218.5-233.7             | 225.9              |
| M                                                                  | KNEE PIVOT HEIGHT              | Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.                                                                    | 241.6-256.8             | 251.3              |
| N                                                                  | BUTTOCK POPLITEAL LENGTH       | The most forward portion of the crevice between the upper and lower legs behind the knee to the fixture's rear vertical surface.                    | 218.0-233.2             | 230.1              |

| HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS, continued |                                    |                                                                                                                                                                                                                                                                      |                         |                    |
|-------------------------------------------------------------------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|--------------------|
| DIMENSION                                                                     | DESCRIPTION                        | DETAILS                                                                                                                                                                                                                                                              | ASSEMBLY DIMENSION (mm) | ACTUAL MEASUREMENT |
| O                                                                             | CHEST DEPTH WITH JACKET            | Measured 254.0 ± 5.1 mm above seat surface                                                                                                                                                                                                                           | 138.5-153.7             | 151.7              |
| P                                                                             | FOOT LENGTH                        | Tip of toe to rear of heel                                                                                                                                                                                                                                           | 137.6-147.8             | 143.6              |
| Q                                                                             | STATURE                            | Lay the dummy out on a flat surface with the rear surfaces of the head, upper torso, buttocks and heels touching the surface and with the bottom of the feet perpendicular to that surface. Measure the distance from the bottom of the feet to the top of the head. | 932.2-957.6             | N/A                |
| R                                                                             | BUTTOCK TO KNEE PIVOT LENGTH       | Knee pivot bolt to the fixture's rear vertical surface.                                                                                                                                                                                                              | 251.4-261.6             | 260.1              |
| S                                                                             | HEAD BREADTH                       | Distance across the widest of the head at its widest point                                                                                                                                                                                                           | 128.3-143.5             | 133.8              |
| T                                                                             | HEAD DEPTH                         | Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsagittal plane.                                                                                                                                          | 167.4-182.6             | 172.7              |
| U                                                                             | HIP BREADTH                        | Distance across the width of the hip at the widest point of the jacket                                                                                                                                                                                               | 200.7-215.9             | 208.9              |
| V                                                                             | SHOULDER BREADTH                   | Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts                                                                                                                                                                      | 236.5-251.7             | 245.4              |
| W                                                                             | FOOT BREADTH                       | The widest part of the foot                                                                                                                                                                                                                                          | 53.6-63.8               | 57.3               |
| X                                                                             | HEAD CIRCUMFERENCE                 | At the largest location                                                                                                                                                                                                                                              | 500.4-515.6             | 513.2              |
| Y                                                                             | CHEST CIRCUMFERENCE WITH JACKET    | Distance around chest at reference location AA, with jacket on.                                                                                                                                                                                                      | 527.1-552.5             | 541.3              |
| Z                                                                             | WAIST CIRCUMFERENCE                | Distance around chest at reference location BB, with jacket on.                                                                                                                                                                                                      | 527.1-552.5             | 532.4              |
| AA                                                                            | REFERENCE LOCATION FOR DIMENSION Y | Reference: 254.0 ± 5.1 MM above the seat surface                                                                                                                                                                                                                     | 248.9-259.1             | 254.0              |
| BB                                                                            | REFERENCE LOCATION FOR DIMENSION Z | Reference: 165.1 ± 5.1 MM above seat surface                                                                                                                                                                                                                         | 160.0-170.2             | 165.0              |

**DATA SHEET D3**  
**HEAD DROP TEST (572.142) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/09/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))  
    X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>45%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

- X   9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.142(c)(3))  
Record the actual distance:                     376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X   10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))  
Record the right side distance:                     501 mm                      
Record the left side distance:                     501 mm

- X   11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.142(c)(4))  
Record actual micro finish:                     24.8 micro inches

- X   12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))  
Record thickness:                     50.9 mm                      
Record width:                     604 mm                      
Record length:                     595 mm

- X   13. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm 0.04$  inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))

- X   14. Complete the following table. (572.142(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 280 \text{ g}$        | 268 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | 5.9 g  |

- X   15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test ID:** D142401

| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 43     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 280         | 268    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | 5.9    | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |



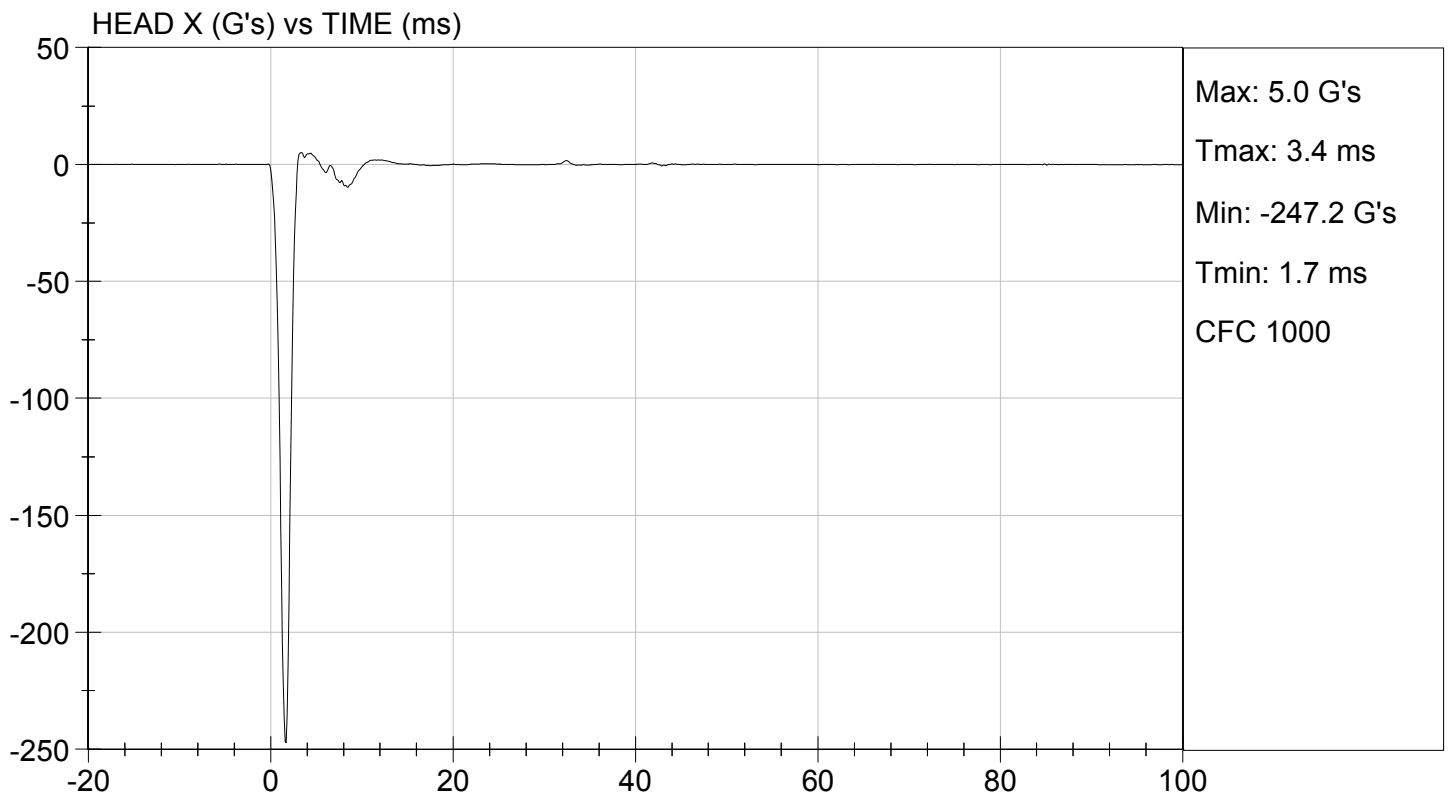
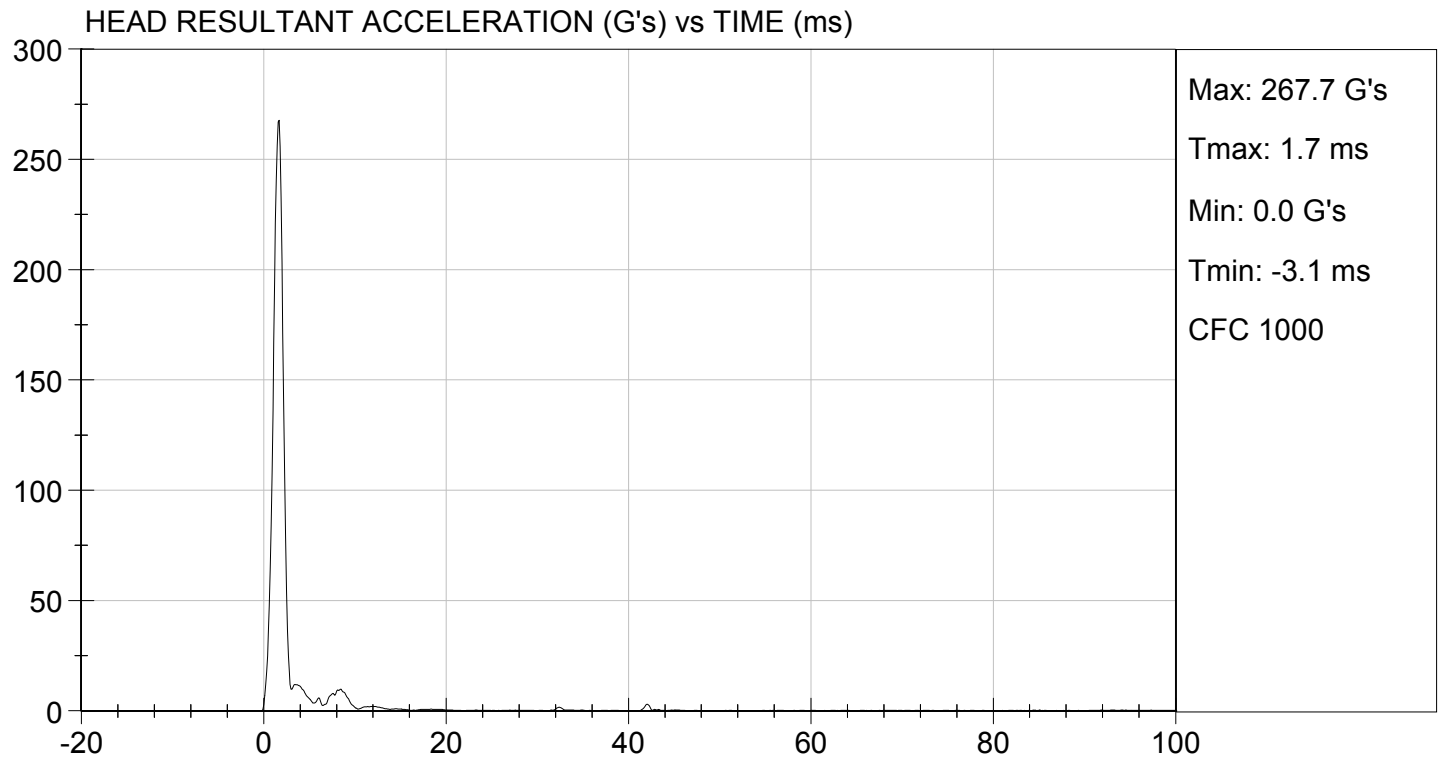
Laboratory Technician

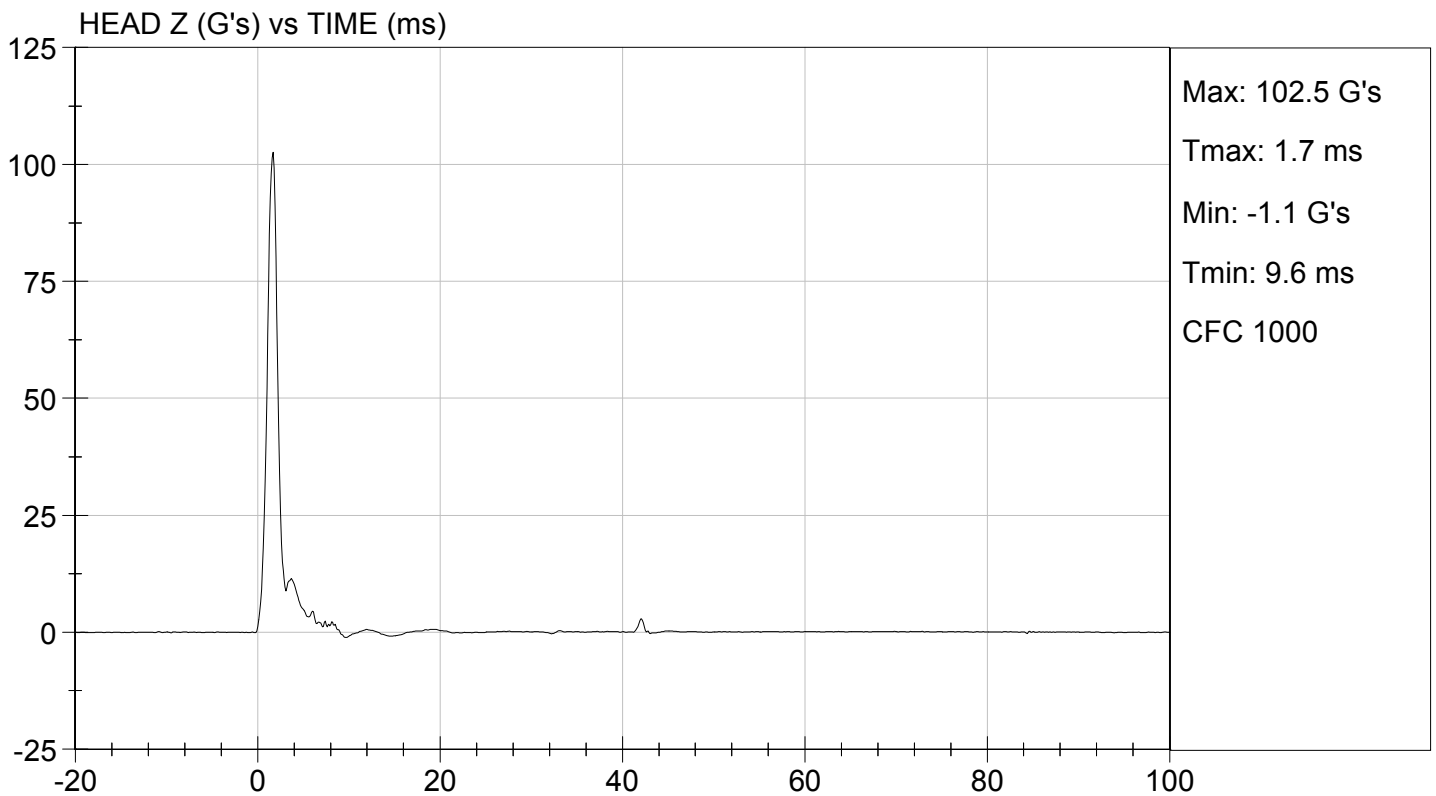
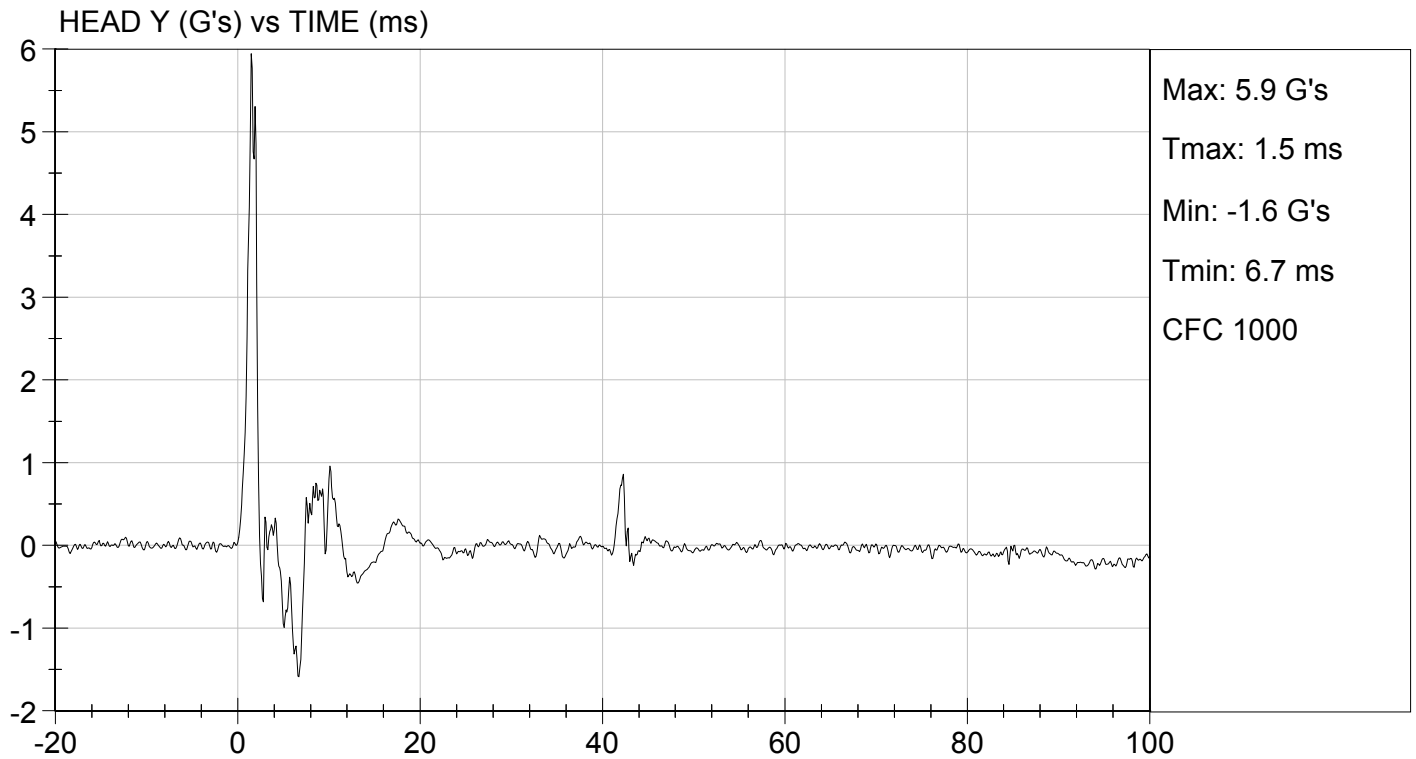
07/09/2014

Test Date



Approved By





**DATA SHEET D4**  
**NECK FLEXION TEST (572.143) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/09/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))  
X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>45%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

- X   9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X   10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X   11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X   12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X   13. Complete the following table:

| Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii)) |         |                                                                                                                             |                         |
|-----------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Parameter                                                       |         | Specification                                                                                                               | Result                  |
| Pendulum impact speed                                           |         | 5.4 m/s $\leq$ speed $\leq$ 5.6 m/s                                                                                         | 5.6 m/s                 |
| Pendulum $\Delta V$<br>with respect to<br>impact speed          | @ 10 ms | 2.0 m/s $\leq \Delta V \leq$ 2.7 m/s                                                                                        | 2.6 m/s                 |
|                                                                 | @ 15 ms | 3.0 m/s $\leq \Delta V \leq$ 4.0 m/s                                                                                        | 3.8 m/s                 |
|                                                                 | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.1 m/s                                                                                        | 5.0 m/s                 |
| Plane D Rotation                                                |         | Peak moment*<br>42 Nm $\leq$ moment $\leq$ 53 Nm during the<br>following rotation range $70^\circ \leq$ angle $\leq$<br>82° | 48.9 Nm @<br>75 degrees |
| Positive Moment Decay**<br>(Flexion)                            |         | Time to decay to 10 Nm 60 ms $\leq$ time<br>$\leq$ 80 ms                                                                    | 67 ms                   |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X   14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION****NECK FLEXION TEST****HYBRID III 3 YEAR OLD****ATD Serial No:** 031**Test I.D:** D142402

| Tested Parameter                            |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                      |       | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Laboratory Relative Humidity                |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                              |       | m/s   | 5.4 to 5.6    | 5.6    | Pass      |
| Pendulum Velocity                           | 10 ms | m/s   | 2.0 to 2.7    | 2.6    | Pass      |
|                                             | 15 ms | m/s   | 3.0 to 4.0    | 3.8    | Pass      |
|                                             | 20 ms | m/s   | 4.0 to 5.1    | 5.0    | Pass      |
| D Plane Rotation                            |       | deg   | 70 to 82      | 75     | Pass      |
| Peak Moment within Deflection Corridor      |       | Nm    | 42.0 to 53.0  | 48.9   | Pass      |
| Positive Moment - Time Curve Decay to 10 Nm |       | ms    | 60.0 to 80.0  | 67.0   | Pass      |
| Overall Test Results                        |       |       |               | Pass   |           |



Laboratory Technician

07/09/2014

Test Date

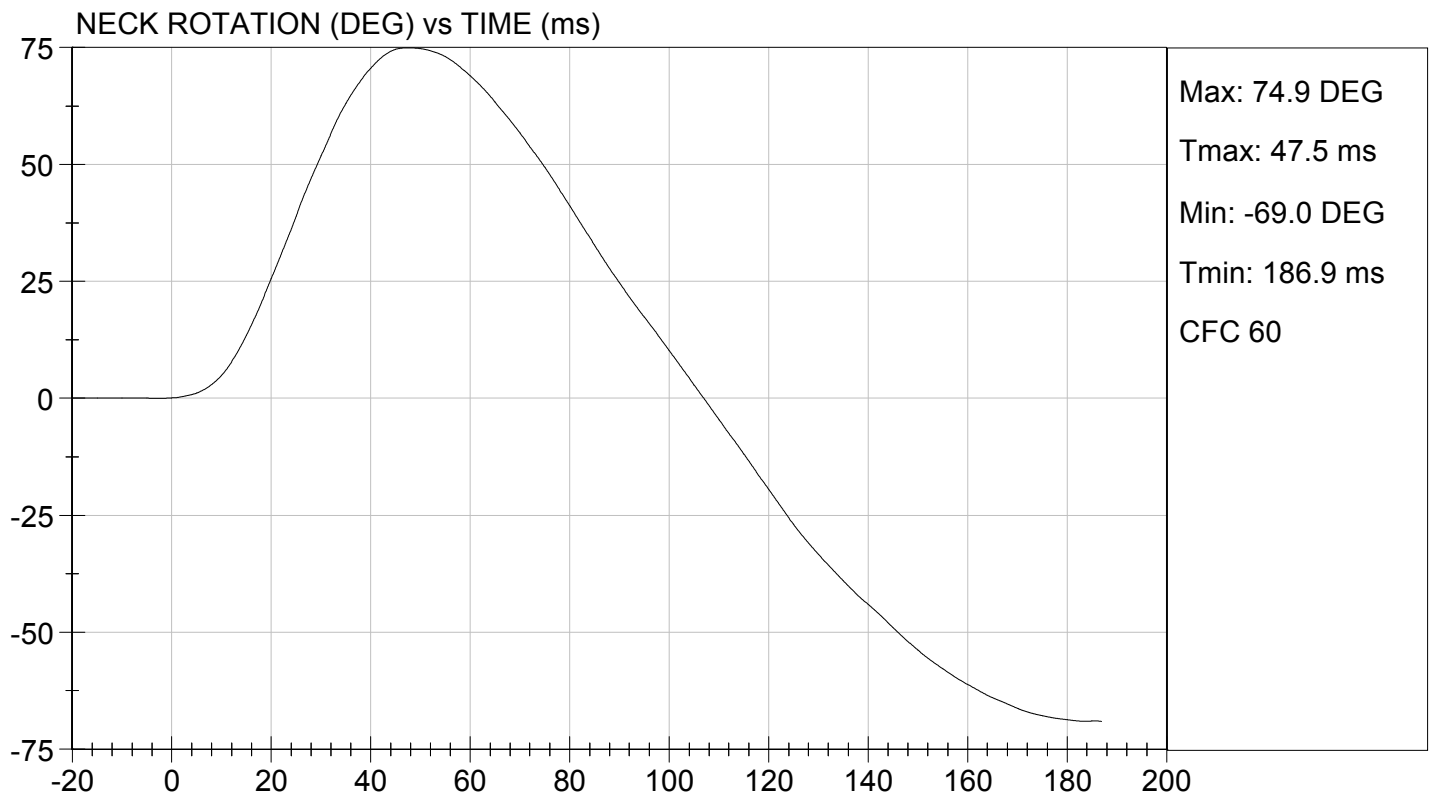
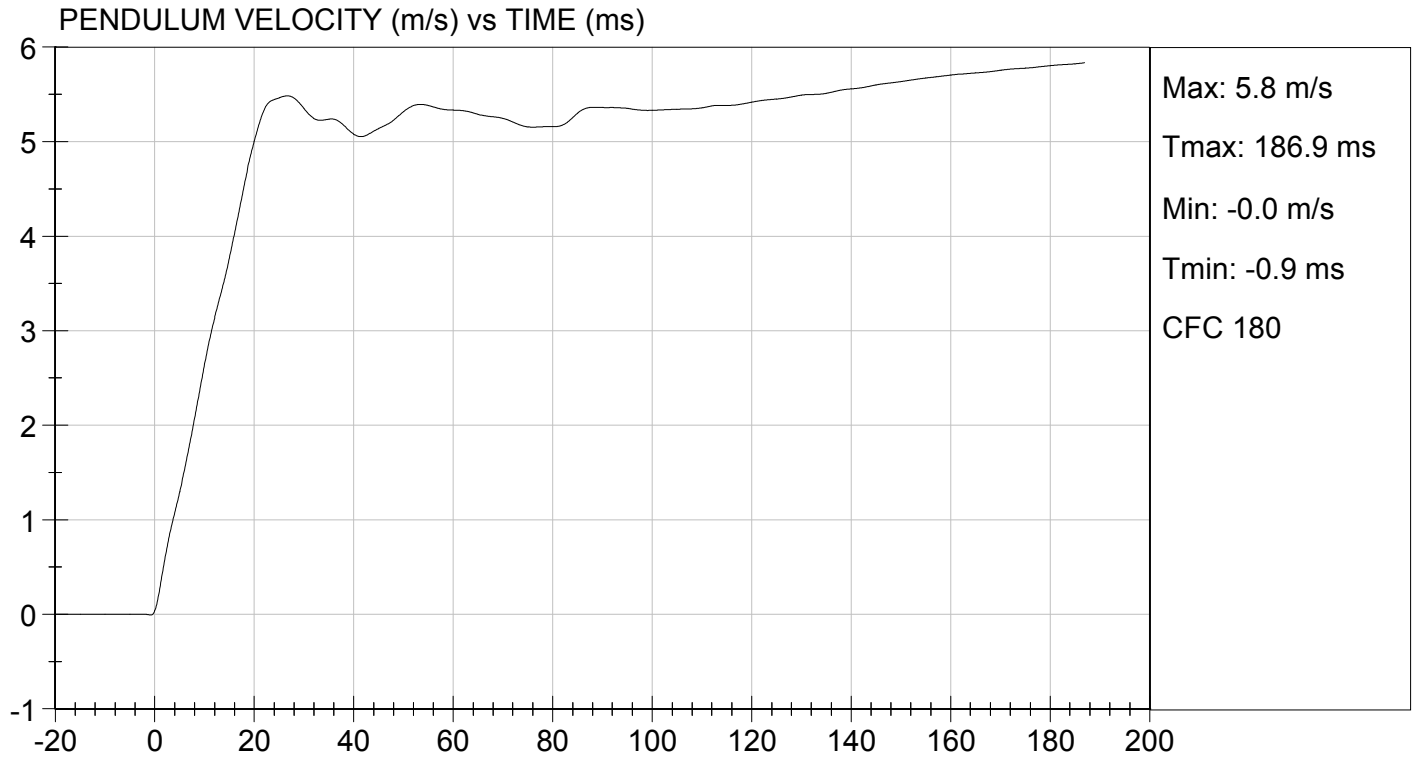


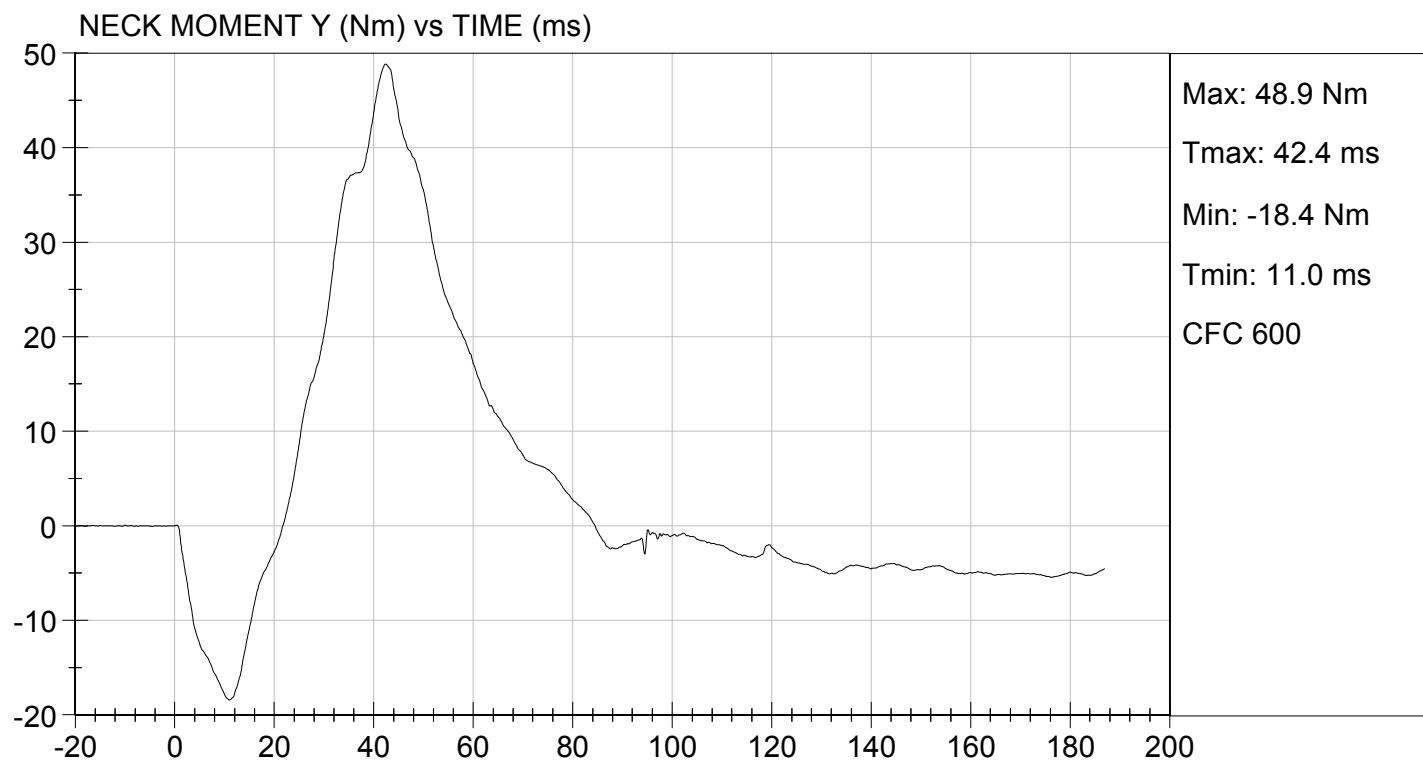
Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 18.37 ft/s, 5.60 m/s

TEST DATE: 07/09/2014  
TEST #: D142402





**DATA SHEET D5**  
**NECK EXTENSION TEST (572.133) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/09/2014

Technician: David Schoedel

- X Pre test calibration  
     Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))  
    X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>45%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

| Parameter                                        |         | Specification                                                                                                     | Result                |
|--------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------|-----------------------|
| Pendulum impact speed                            |         | 3.55 m/s $\leq$ speed $\leq$ 3.75 m/s                                                                             | 3.60 m/s              |
| Pendulum $\Delta V$ with respect to impact speed | @ 6 ms  | 1.0 m/s $\leq \Delta V \leq$ 1.4 m/s                                                                              | 1.4 m/s               |
|                                                  | @ 10 ms | 1.9 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                              | 2.2 m/s               |
|                                                  | @ 14 ms | 2.8 m/s $\leq \Delta V \leq$ 3.5 m/s                                                                              | 3.0 m/s               |
| Plane D Rotation                                 |         | Peak moment* -53.3 Nm $\leq$ moment $\leq$ -43.7 Nm during the following rotation range 83 $\leq$ angle $\leq$ 93 | -44.2 Nm @ 88 degrees |
| Negative Moment Decay** (Extension)              |         | Time to decay to -10 Nm 60 ms $\leq$ time $\leq$ 80 ms                                                            | 67 ms                 |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D:** D142403

| Tested Parameter                             |       | Units | Specification  | Result | Pass/Fail |
|----------------------------------------------|-------|-------|----------------|--------|-----------|
| Laboratory Temperature                       |       | deg C | 20.6 to 22.2   | 21.1   | Pass      |
| Laboratory Relative Humidity                 |       | %     | 10 to 70       | 45     | Pass      |
| Pendulum Speed                               |       | m/s   | 3.55 to 3.75   | 3.60   | Pass      |
| Pendulum Velocity                            | 6 ms  | m/s   | 1.0 to 1.4     | 1.4    | Pass      |
|                                              | 10 ms | m/s   | 1.9 to 2.5     | 2.2    | Pass      |
|                                              | 14 ms | m/s   | 2.8 to 3.5     | 3.0    | Pass      |
| D Plane Rotation                             |       | deg   | 83 to 93       | 88     | Pass      |
| Peak Moment within Deflection Corridor       |       | Nm    | -53.3 to -43.7 | -44.2  | Pass      |
| Negative Moment - Time Curve Decay to -10 Nm |       | ms    | 60.0 to 80.0   | 67.0   | Pass      |
| Overall Test Results                         |       |       |                |        | Pass      |

*David Schoedel*  
Laboratory Technician

07/09/2014

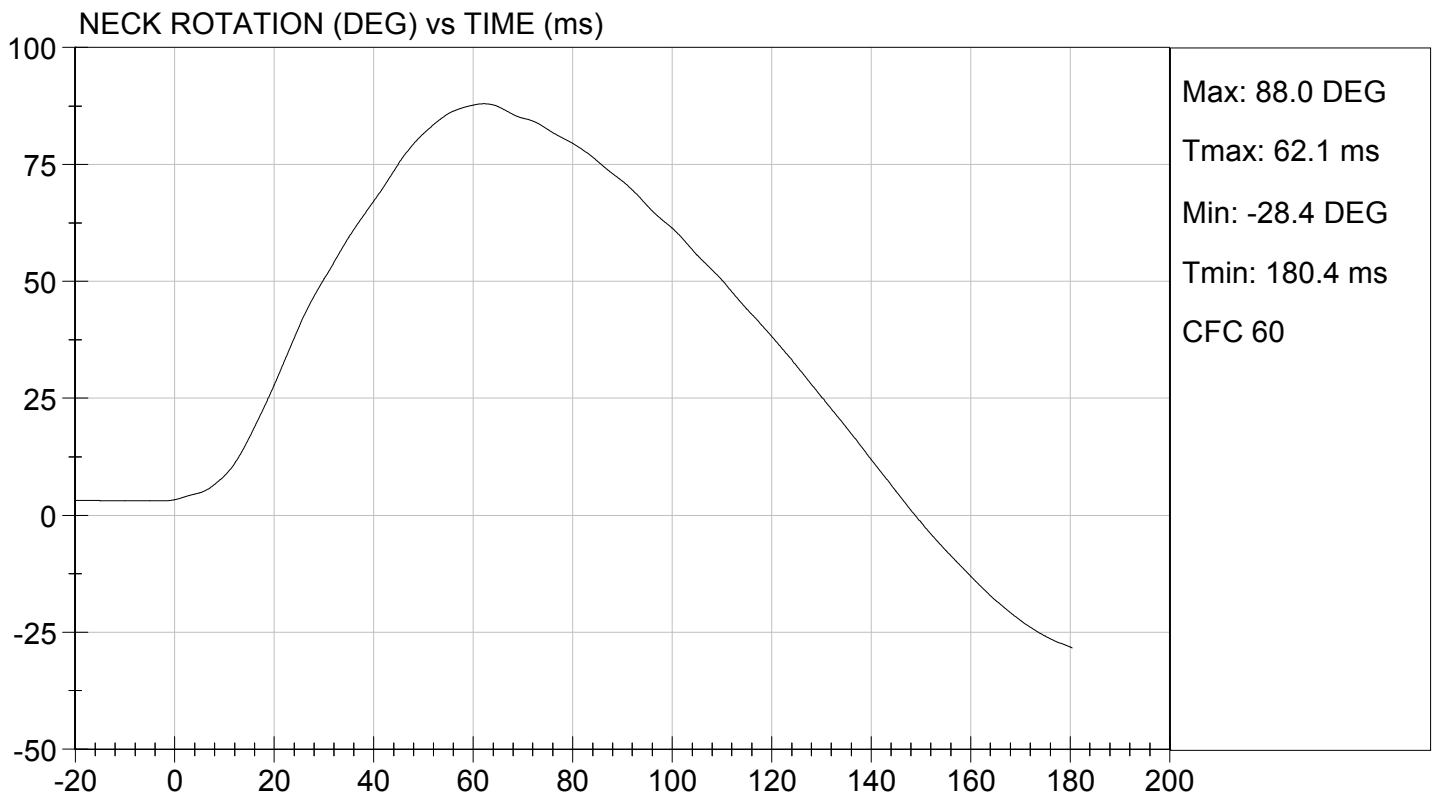
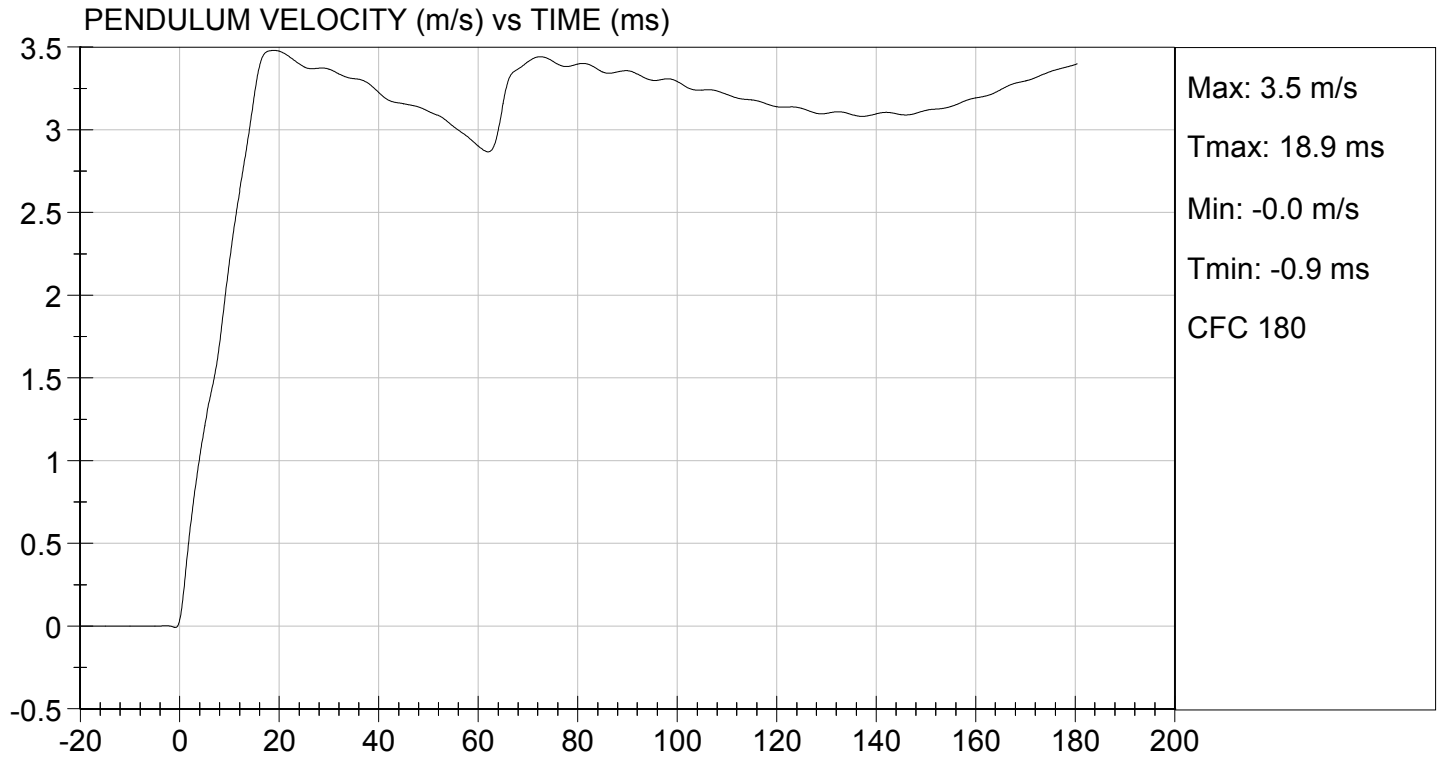
Test Date

*Jeff Leonard*  
Approved By



TEST DESC: NECK EXTENSION  
VELOCITY: 11.82 ft/s, 3.60 m/s

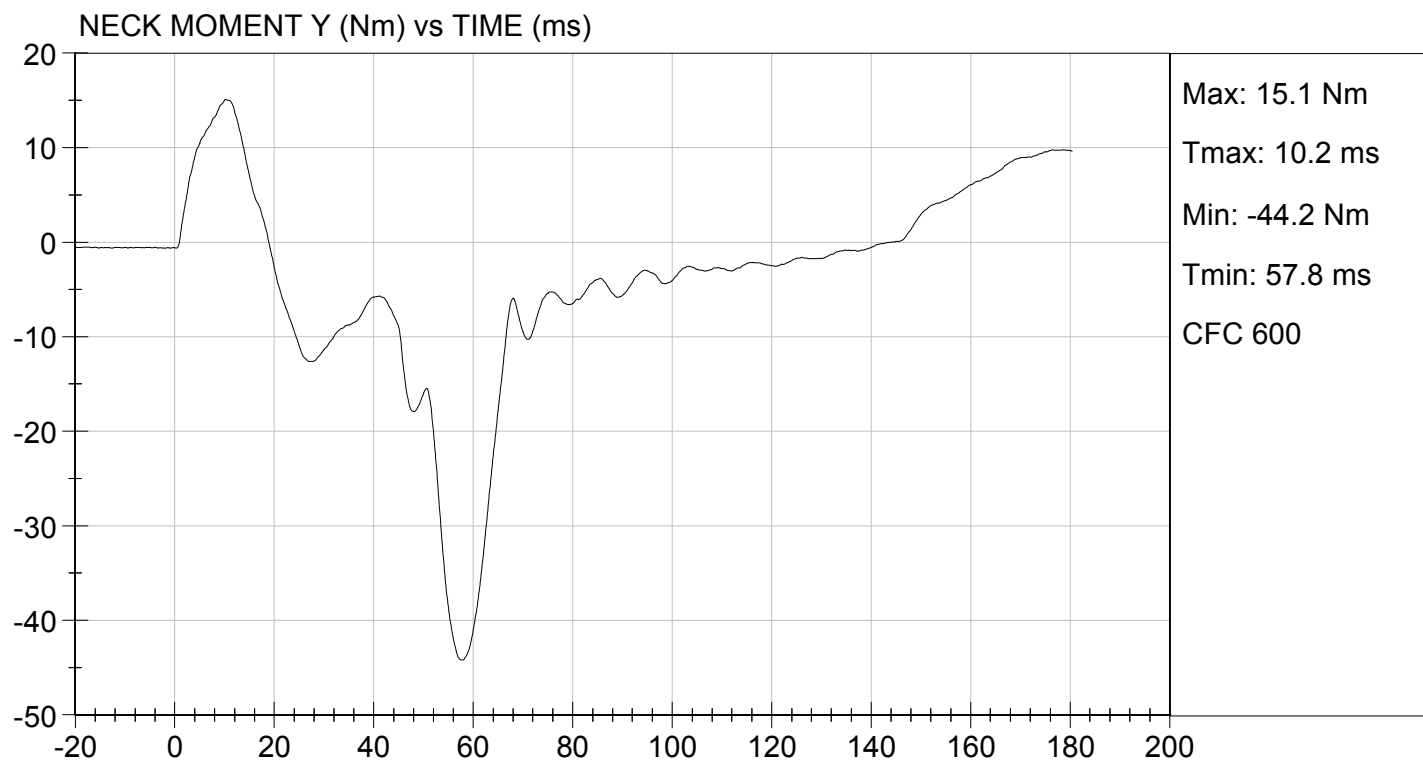
TEST DATE: 07/09/2014  
TEST #: D142403





TEST DESC: NECK EXTENSION  
VELOCITY: 11.82 ft/s, 3.60 m/s

TEST DATE: 07/09/2014  
TEST #: D142403



**DATA SHEET D6**  
**THORAX IMPACT TEST (572.144) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/09/2014

Technician: Joseph Radke

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))  
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11D.
- ☒ 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))
- ☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>45%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- ☒ 5. Remove the arms.
- ☒ 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
- ☒ - No damage
- ☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.
- ☐ - The following repairs or replacement was performed. Record damage.

- X   7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))
- X   8. Level the middle rib both longitudinally and laterally  $\pm 0.5^\circ$ . (572.144(c)(3))
- X   9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.144(c)(3))
- X   10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within  $\pm 2.5$  mm within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X   12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X   13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

- X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

| Parameter*                                              | Specification                                              | Result  |
|---------------------------------------------------------|------------------------------------------------------------|---------|
| Test Probe Speed                                        | $5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$   | 6.1 m/s |
| Chest Compression                                       | $32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$ | 34 mm   |
| Peak force** between 32 and 38 mm chest compression     | $680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$  | 697 N   |
| Peak force** between 12.5 and 32.0 mm chest compression | Peak force $\leq 910 \text{ N}$                            | 771 N   |
| Internal Hysteresis***                                  | $65\% \leq \text{hysteresis} \leq 85\%$                    | 76%     |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.144(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

- X 17. Plots of chest compression, pendulum acceleration, pendulum force, and force versus deflection follow this sheet.

  
Signature

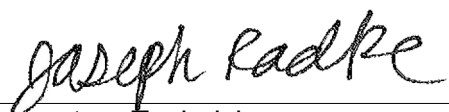
07/09/2014  
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**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**HYBRID III 3 YEAR OLD**

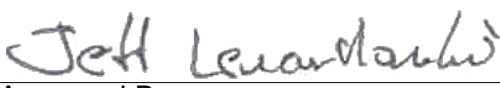
**ATD Serial No:** 031

**Test I.D:** D142404

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature                        | deg C | 20.6 to 22.2  | 21.1   | Pass      |
| Laboratory Relative Humidity                  | %     | 10 to 70      | 44     | Pass      |
| Probe Velocity                                | m/s   | 5.9 to 6.1    | 6.1    | Pass      |
| Peak Deflection                               | mm    | 32 to 38      | 34     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 680 to 810    | 697    | Pass      |
| Internal Hysteresis                           | %     | 65 to 85      | 76     | Pass      |
| Max Force 12.5 mm - 32 mm Deflection          | N     | <= 910        | 771    | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

  
Laboratory Technician

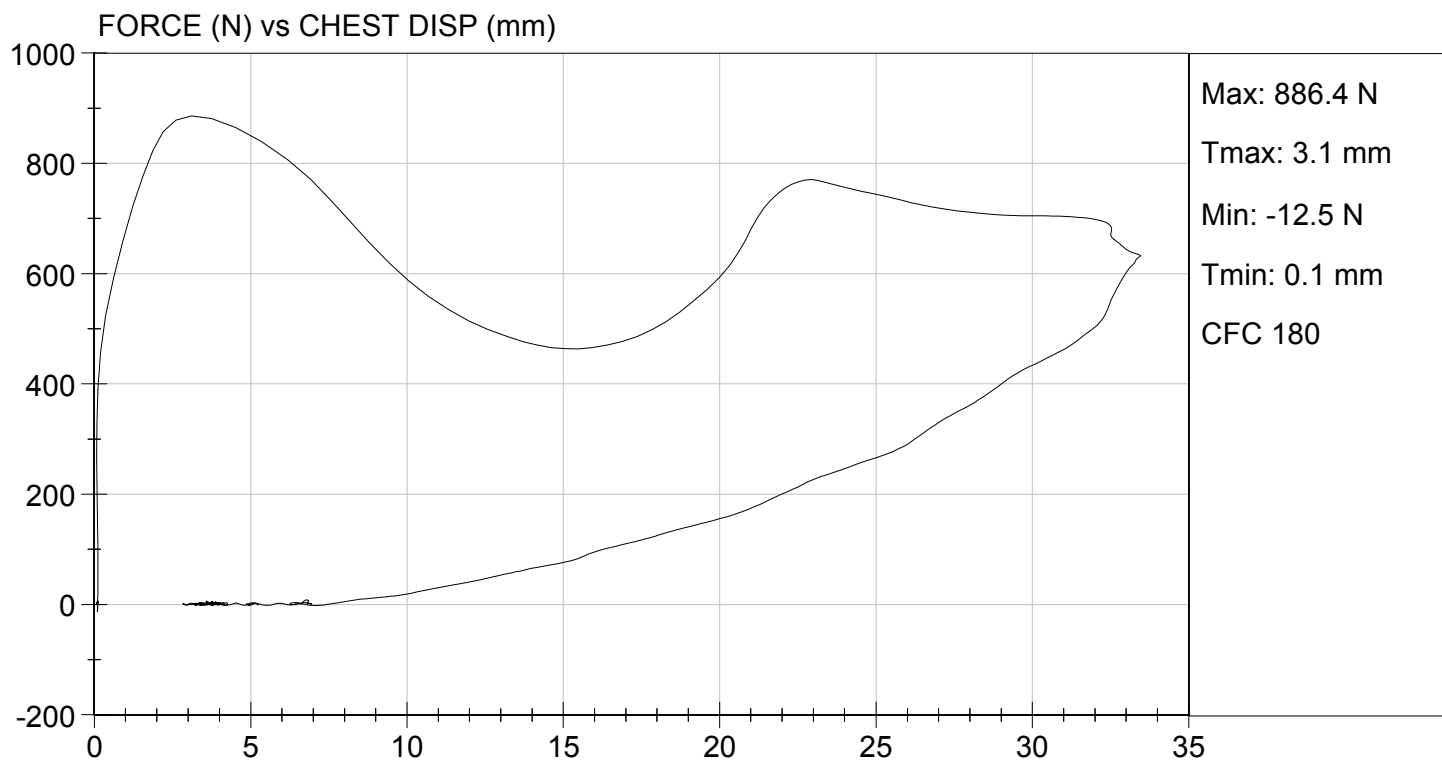
07/09/2014  
Test Date

  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 19.84 ft/s, 6.1 m/s

TEST DATE: 07/09/2014  
TEST #: D142404



**DATA SHEET D7**  
**TORSO FLEXION TEST (572.145) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/09/2014

Technician: David Schoedel

- ☒ Pre test calibration  
☐ Post test calibration verification

Test attempt no. 1 (when successive torso flexion tests are necessary)

- ☒ 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))  
☒ N/A, ONLY torso flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13D.
- ☒ 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).  
☒ with legs below the femurs.  
☐ without legs below the femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>45%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- ☒ 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
- ☒ 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within  $\pm 1^\circ$  and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
- ☒ 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
- ☒ 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

- X   9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between  $0^\circ$  and  $30^\circ \pm 2^\circ$ . The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))
- X   10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near  $0^\circ$ . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
- X   11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))
- X   12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))  
Record reference plane angle (max. allowed  $15^\circ$ )     See Result Table
- X   13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- X   14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the torso reference plane reaches  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.145(c)(5))
- X   15. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))
- X   16. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- X   17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- X   18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

| Parameter                         | Specification                                                 | Result               |
|-----------------------------------|---------------------------------------------------------------|----------------------|
| Initial ref. plane angle          | Angle $\leq 15^\circ$                                         | $2^\circ$            |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | $0.7^\circ/\text{s}$ |
| Force at $45^\circ \pm 0.5^\circ$ | $130 \text{ N} \leq \text{force} \leq 180 \text{ N}$          | 146 N                |
| Final ref. plane angle            | Initial ref. plane angle $\pm 10^\circ$                       | $4^\circ$            |

- X   19. A plot of the force versus time follows this sheet.

David Schoedel  
Signature

07/09/2014  
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D:** D142407

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 43     | Pass      |
| Initial Angle                | deg   | 0 to 22       | 2      | Pass      |
| Return Angle                 | deg   | 0 to 8        | 4      | Pass      |
| Force at 45 deg              | N     | 130 to 180    | 146    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.7    | Pass      |
| Overall Test Results         |       |               |        | Pass      |

David Schoedel

Laboratory Technician

Jeff Leonard

Approved By

07/09/2014

Test Date

## DATA SHEET D8

### PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79758     | 05/14/2014               | 11/14/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79759     | 05/14/2014               | 11/14/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79761     | 05/14/2014               | 11/14/2014               |
| NECK TRANSDUCER                       | Denton       | 3303                | 233        | 02/13/2014               | 08/13/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78843     | 02/04/2014               | 08/04/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P78951     | 02/04/2014               | 08/04/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P82291     | 02/04/2014               | 08/04/2014               |
| CHEST POTENTIOMETER                   | Servo        | 08C1-3179           | 031        | 02/06/2014               | 08/06/2014               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| (2) LEFT FEMUR                        | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AH467      | 2/20/2014                | 8/20/2014                |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 5/1/2014                 | 11/1/2014                |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P77579     | 1/10/2014                | 7/10/2014                |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 4/15/2014                | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 4/15/2014                | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET D3**  
**HEAD DROP TEST (572.142) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 09/12/2014

Technician: Jessica Gall

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive head drops are necessary)

- X  1. It has been at least 2 hours since the last head drop. (572.142(c)(5))  
 X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- X  3. Accelerometers and their respective mounts are smooth and clean.
- X  4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- X  5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X  6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>47%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X  8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.142(c)(3))  
Record the actual distance: 376 mm

**NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.

- X 10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.142(c)(4))  
Record actual micro finish: 24.8 micro inches
- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm
- X 13. Drop the head assembly from a height of  $376.0 \pm 1.0$  mm (14.8 inches  $\pm 0.04$  inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))
- X 14. Complete the following table. (572.142(b)):

| Parameter                           | Specification                                    | Result |
|-------------------------------------|--------------------------------------------------|--------|
| Peak resultant acceleration         | $250 \text{ g} \leq x \leq 280 \text{ g}$        | 278 g  |
| Resultant versus time history curve | Unimodal                                         | Yes    |
| Oscillations after the main pulse   | Less than 10% of the peak resultant acceleration | Yes    |
| Lateral acceleration                | y-axis acceleration $\leq 15 \text{ g}$          | -9.5 g |

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

Jessica Hall  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test ID:** D143151

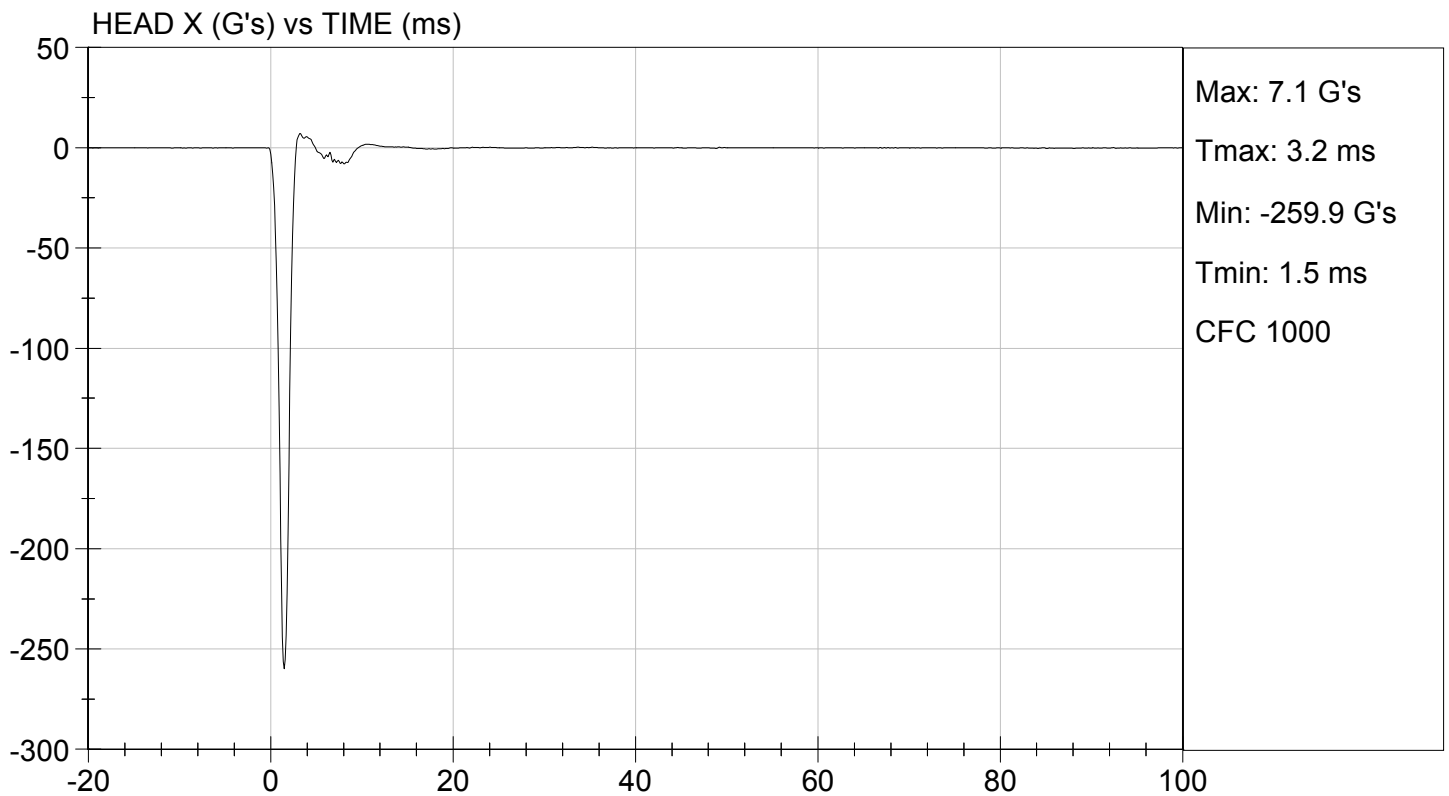
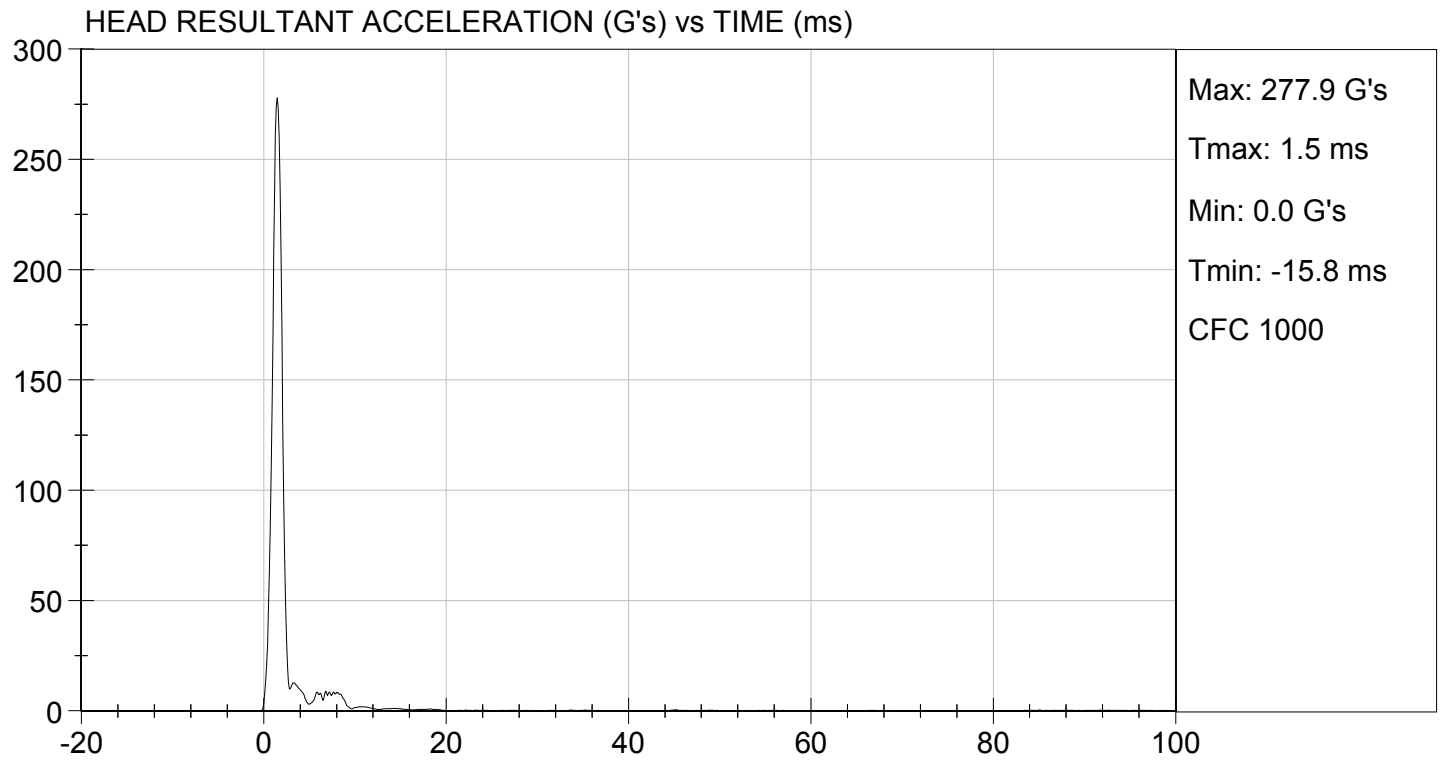
| Tested Parameter             | Units | Specification      | Result | Pass/Fail |
|------------------------------|-------|--------------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6       | 21.1   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70           | 45     | Pass      |
| Peak Resultant Acceleration  | G's   | 250 to 280         | 278    | Pass      |
| Peak Lateral Acceleration    | G's   | <= +/- 15.0        | -9.5   | Pass      |
| Unimodal                     | N/A   | Yes                | Yes    | Pass      |
| Oscillations                 | N/A   | within 10% of peak | Yes    | Pass      |
| Overall Test Results         |       |                    |        | Pass      |

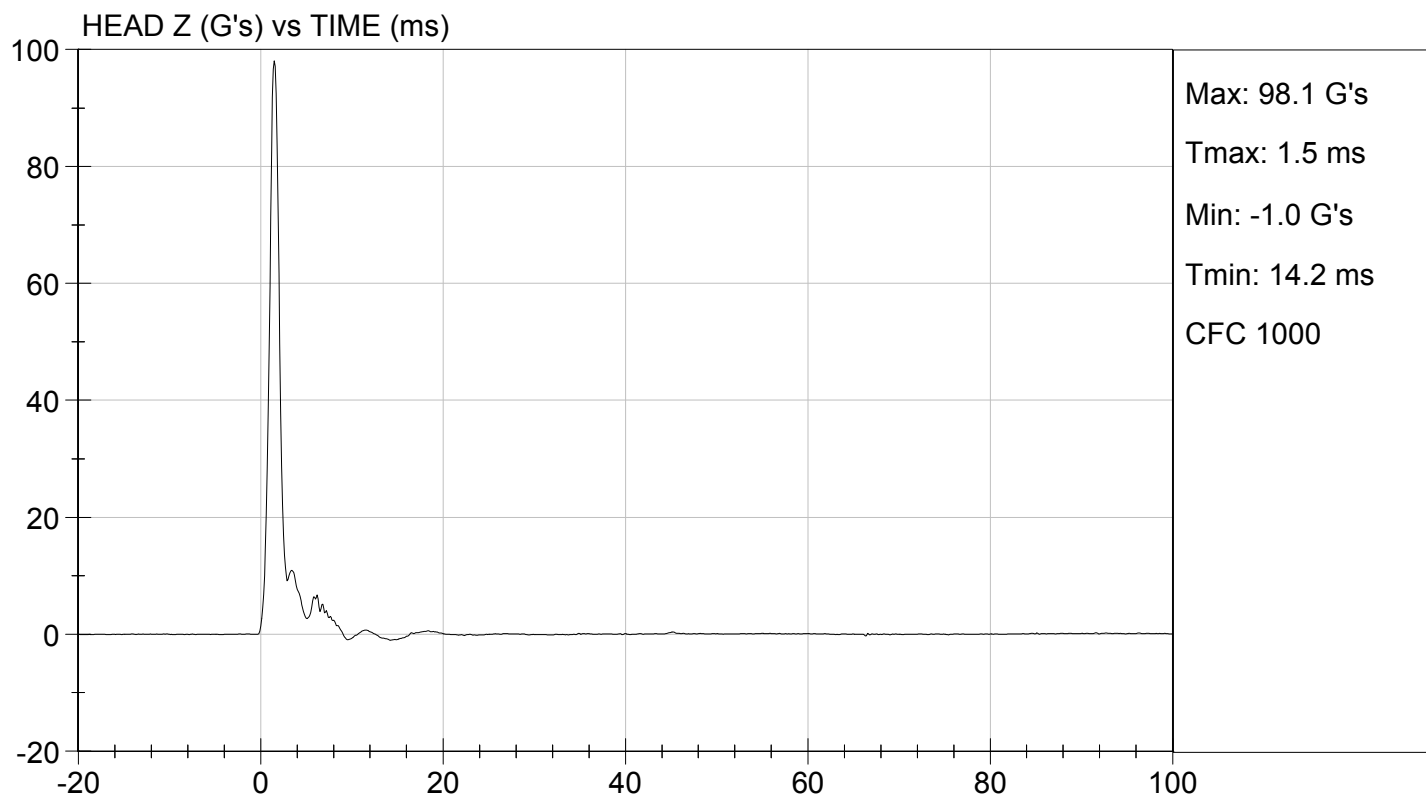
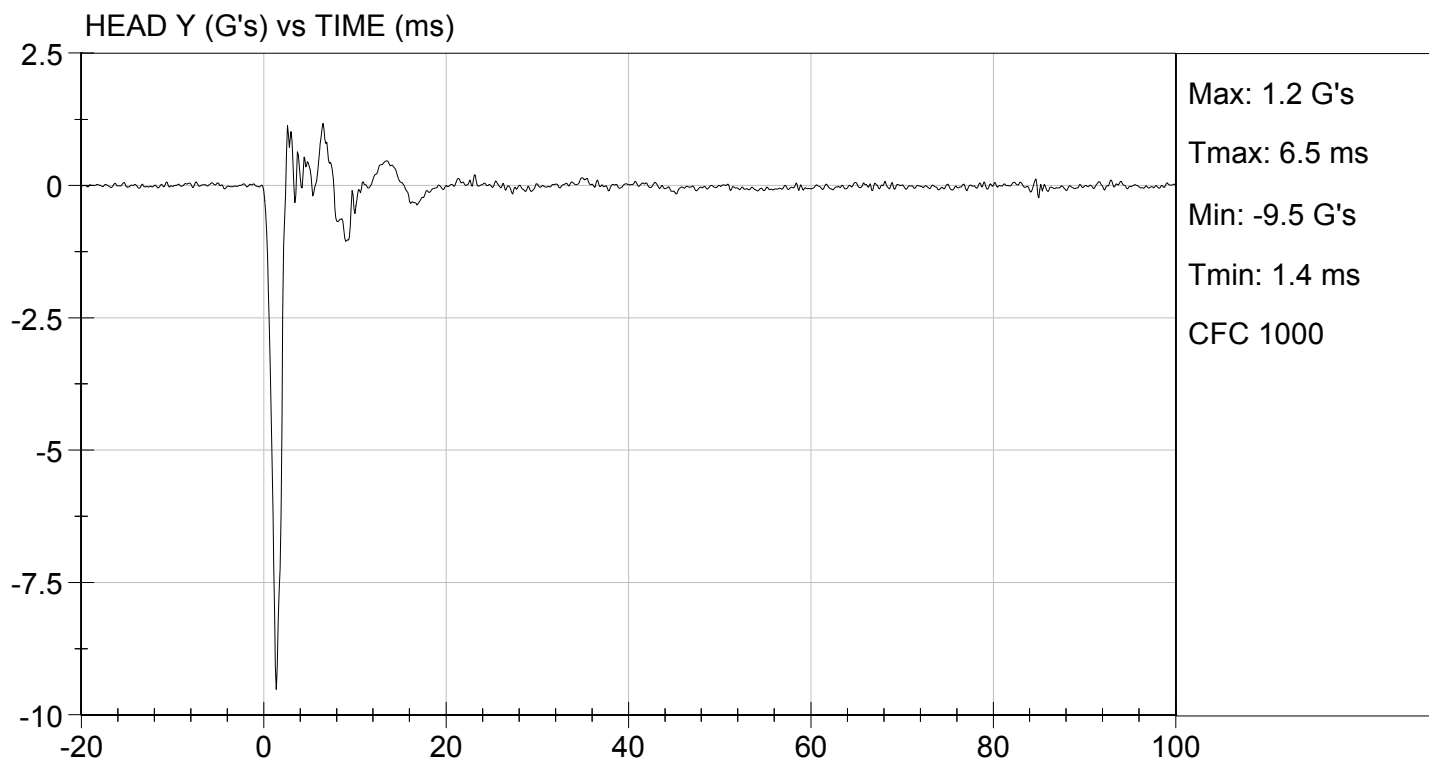
Jessica Gall  
Laboratory Technician

09/12/2014

Test Date

Jeff Leonard  
Approved By





**DATA SHEET D4**  
**NECK FLEXION TEST (572.143) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
 X  Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

- X  1. It has been at least 30 minutes since the last neck test. (572.146(p))  
    X     N/A, this is the first neck test performed
- X  2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X  3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>47%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X  4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X  5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X  7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X  8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

- X   9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X   10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X   11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X   12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X   13. Complete the following table:

| Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii)) |         |                                                                                                                             |                         |
|-----------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Parameter                                                       |         | Specification                                                                                                               | Result                  |
| Pendulum impact speed                                           |         | 5.4 m/s $\leq$ speed $\leq$ 5.6 m/s                                                                                         | 5.6 m/s                 |
| Pendulum $\Delta V$<br>with respect to<br>impact speed          | @ 10 ms | 2.0 m/s $\leq \Delta V \leq$ 2.7 m/s                                                                                        | 2.6 m/s                 |
|                                                                 | @ 15 ms | 3.0 m/s $\leq \Delta V \leq$ 4.0 m/s                                                                                        | 3.7 m/s                 |
|                                                                 | @ 20 ms | 4.0 m/s $\leq \Delta V \leq$ 5.1 m/s                                                                                        | 4.9 m/s                 |
| Plane D Rotation                                                |         | Peak moment*<br>42 Nm $\leq$ moment $\leq$ 53 Nm during the<br>following rotation range $70^\circ \leq$ angle $\leq$<br>82° | 44.9 Nm @<br>76 degrees |
| Positive Moment Decay**<br>(Flexion)                            |         | Time to decay to 10 Nm 60 ms $\leq$ time<br>$\leq$ 80 ms                                                                    | 68 ms                   |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X   14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION****NECK FLEXION TEST****HYBRID III 3 YEAR OLD****ATD Serial No:** 031**Test I.D:** D143152

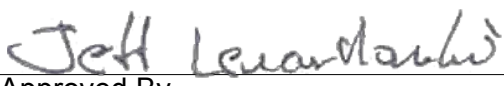
| Tested Parameter                            |       | Units | Specification | Result | Pass/Fail |
|---------------------------------------------|-------|-------|---------------|--------|-----------|
| Laboratory Temperature                      |       | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Laboratory Relative Humidity                |       | %     | 10 to 70      | 45     | Pass      |
| Pendulum Speed                              |       | m/s   | 5.4 to 5.6    | 5.6    | Pass      |
| Pendulum Velocity                           | 10 ms | m/s   | 2.0 to 2.7    | 2.6    | Pass      |
|                                             | 15 ms | m/s   | 3.0 to 4.0    | 3.7    | Pass      |
|                                             | 20 ms | m/s   | 4.0 to 5.1    | 4.9    | Pass      |
| D Plane Rotation                            |       | deg   | 70 to 82      | 76     | Pass      |
| Peak Moment within Deflection Corridor      |       | Nm    | 42.0 to 53.0  | 44.9   | Pass      |
| Positive Moment - Time Curve Decay to 10 Nm |       | ms    | 60.0 to 80.0  | 68     | Pass      |
| Overall Test Results                        |       |       |               | Pass   |           |



Laboratory Technician

09/11/2014

Test Date

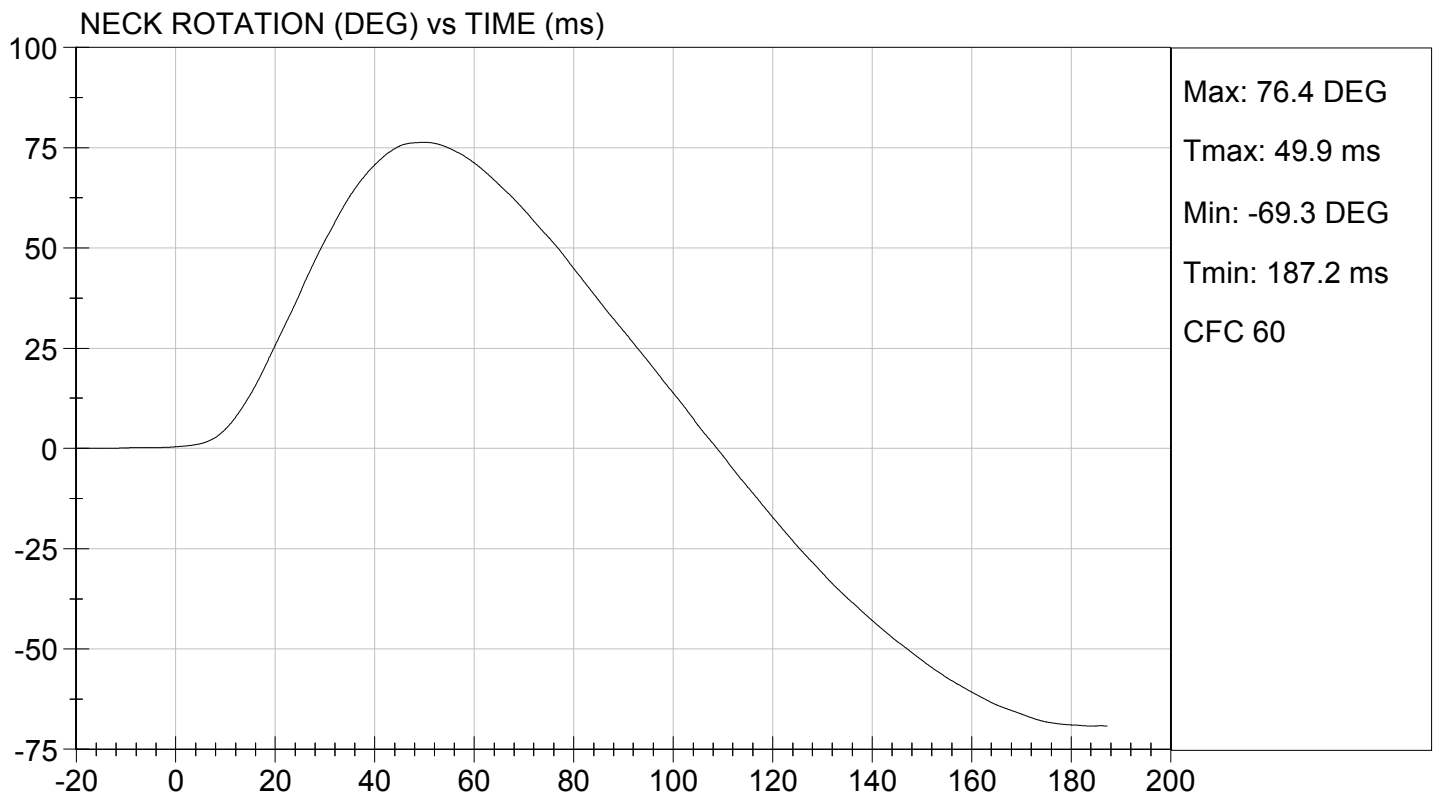
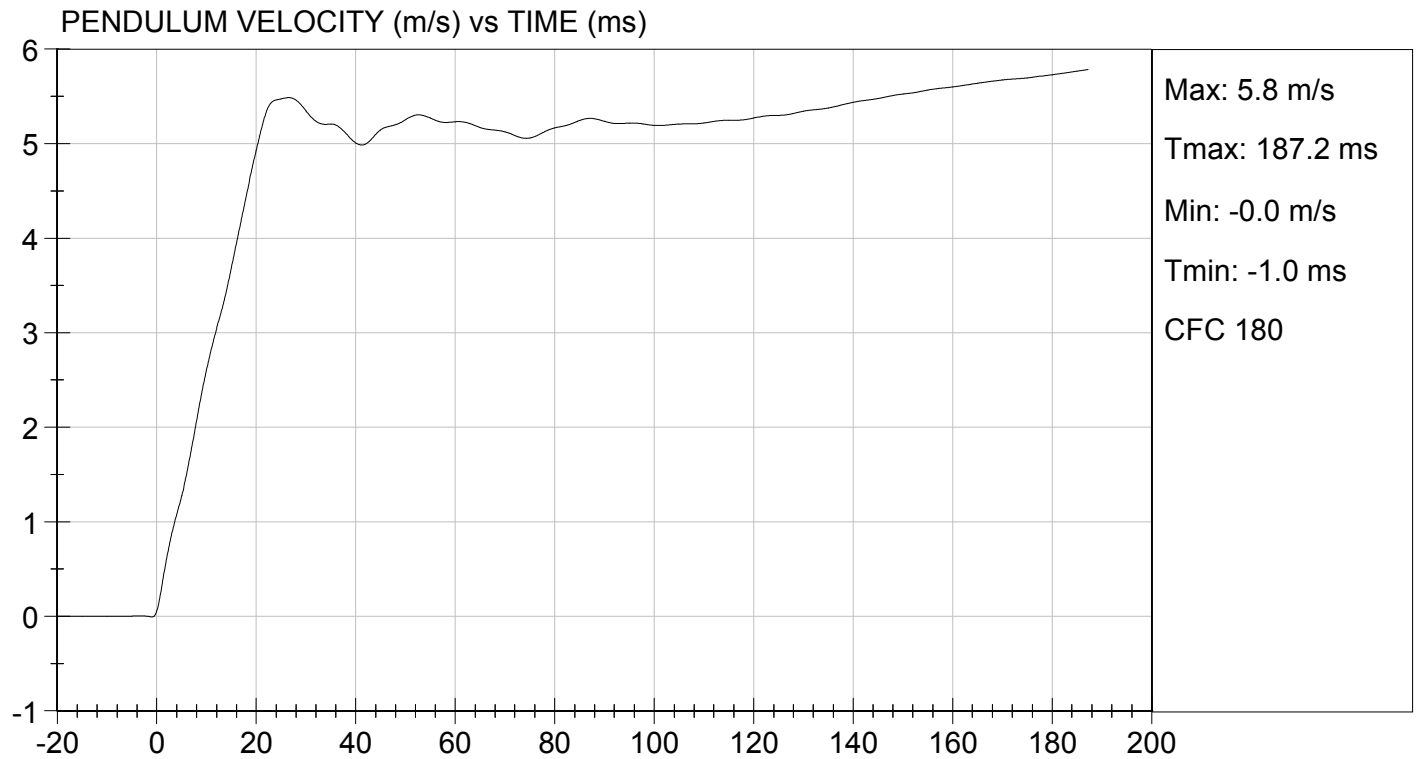


Approved By



TEST DESC: NECK FLEXION  
VELOCITY: 18.37 ft/s, 5.60 m/s

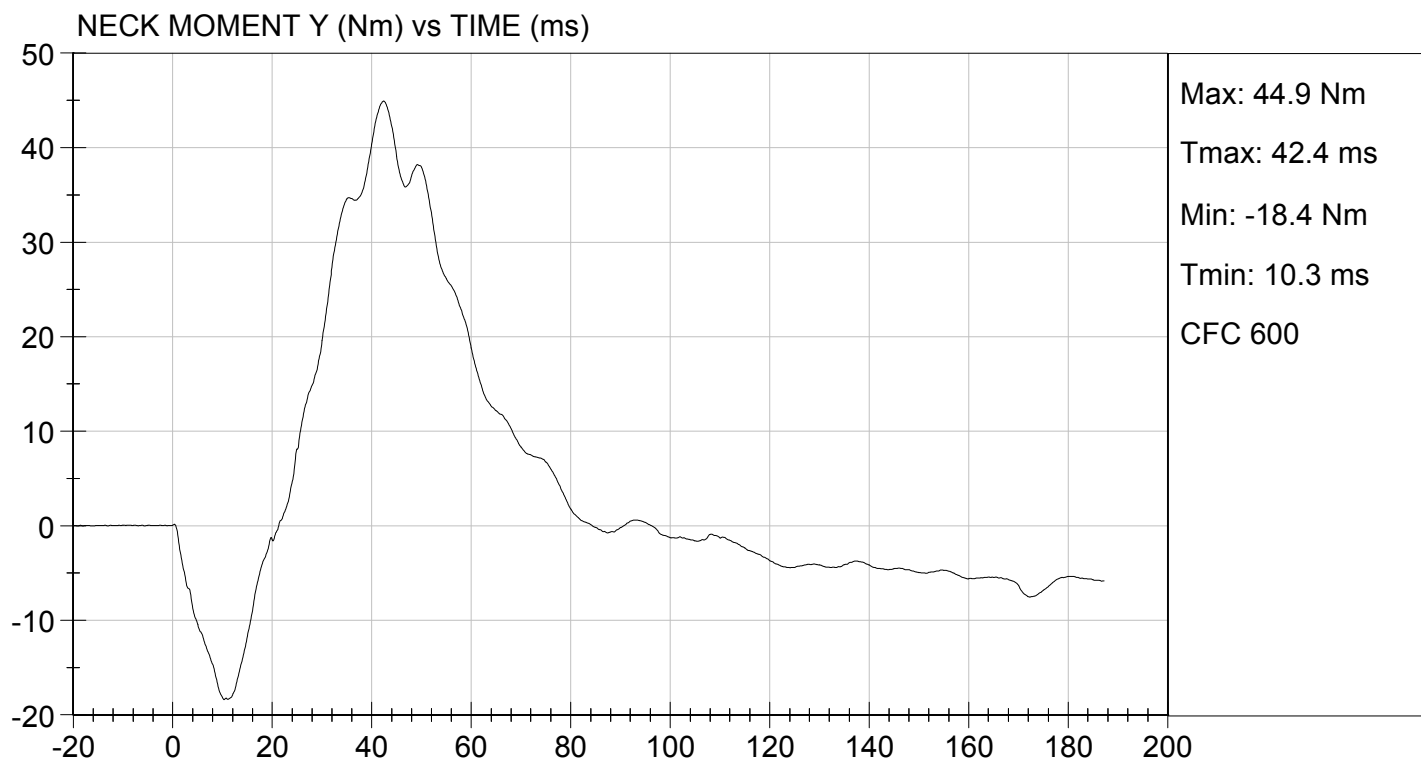
TEST DATE: 09/11/2014  
TEST #: D143152





TEST DESC: NECK FLEXION  
VELOCITY: 18.37 ft/s, 5.60 m/s

TEST DATE: 09/11/2014  
TEST #: D143152



**DATA SHEET D5**  
**NECK EXTENSION TEST (572.133) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 09/12/2014

Technician: David Schoedel

- Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive extension tests are necessary)

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))  
    X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>47%</u>    |
| Record the minimum humidity    | <u>43%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.  
Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

| Parameter                                        |         | Specification                                                                                                     | Result                |
|--------------------------------------------------|---------|-------------------------------------------------------------------------------------------------------------------|-----------------------|
| Pendulum impact speed                            |         | 3.55 m/s $\leq$ speed $\leq$ 3.75 m/s                                                                             | 3.73 m/s              |
| Pendulum $\Delta V$ with respect to impact speed | @ 6 ms  | 1.0 m/s $\leq \Delta V \leq$ 1.4 m/s                                                                              | 1.3 m/s               |
|                                                  | @ 10 ms | 1.9 m/s $\leq \Delta V \leq$ 2.5 m/s                                                                              | 2.0 m/s               |
|                                                  | @ 14 ms | 2.8 m/s $\leq \Delta V \leq$ 3.5 m/s                                                                              | 2.8 m/s               |
| Plane D Rotation                                 |         | Peak moment* -53.3 Nm $\leq$ moment $\leq$ -43.7 Nm during the following rotation range 83 $\leq$ angle $\leq$ 93 | -48.5 Nm @ 84 degrees |
| Negative Moment Decay** (Extension)              |         | Time to decay to -10 Nm 60 ms $\leq$ time $\leq$ 80 ms                                                            | 67 ms                 |

\*The moment is a direct reading from the load cell

\*\*Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

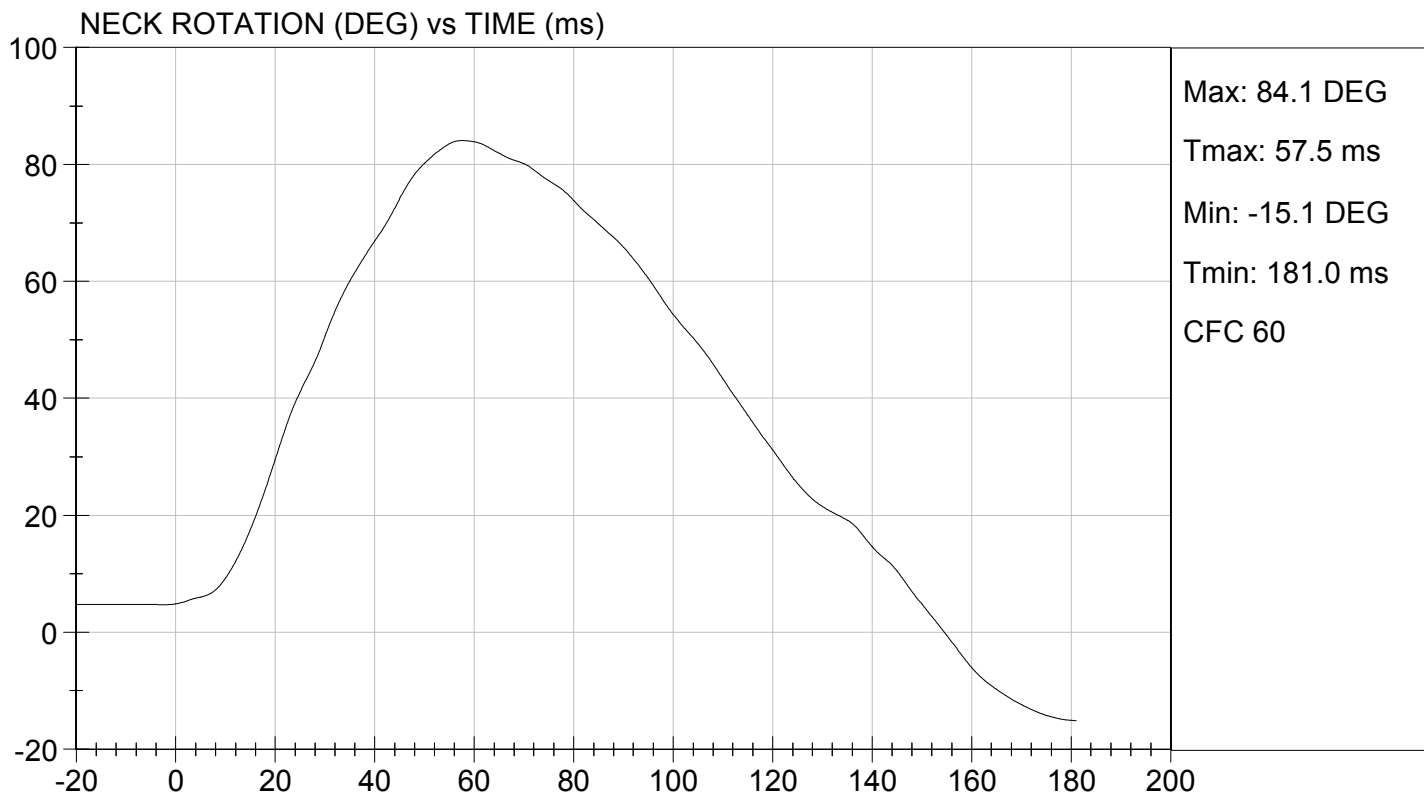
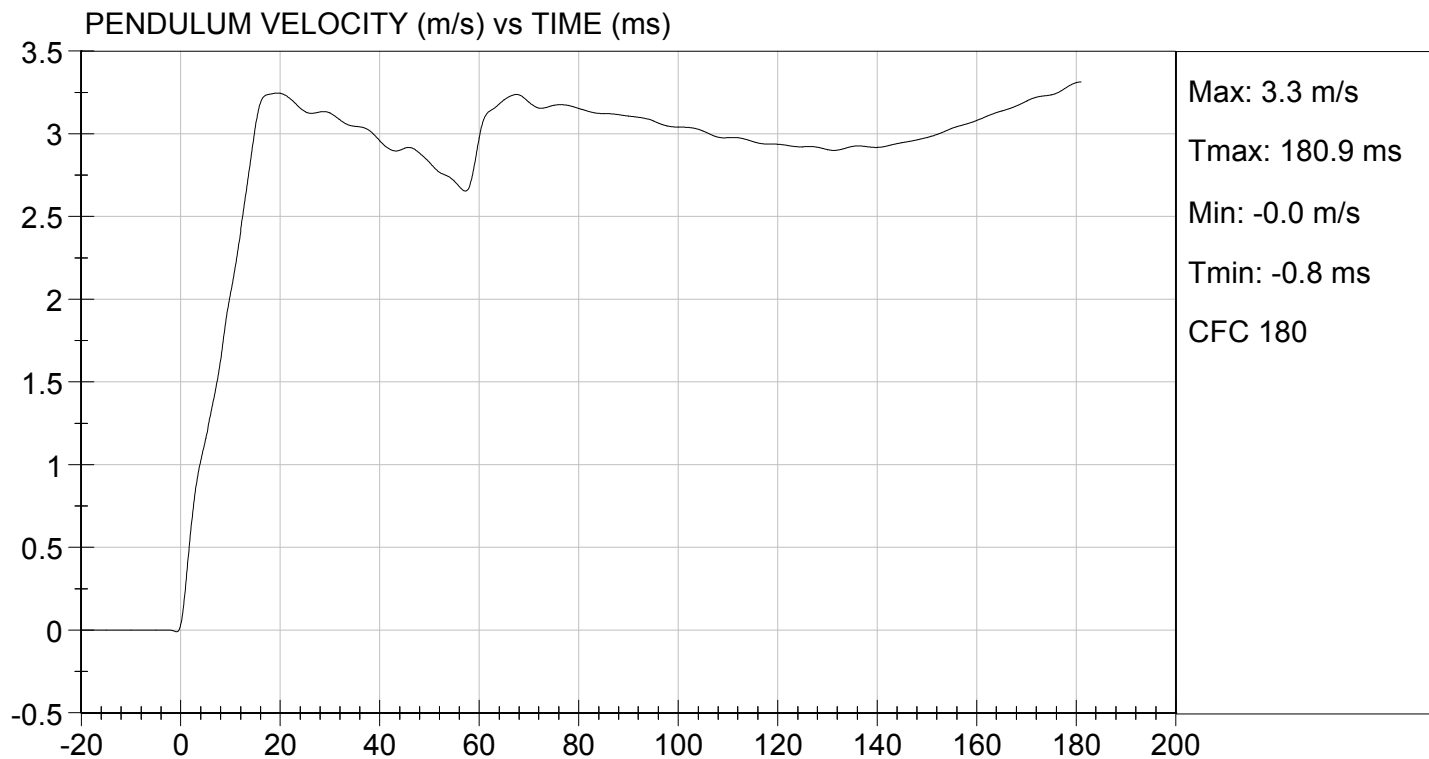
**Test I.D:** D143153

| Tested Parameter                             |       | Units | Specification  | Result | Pass/Fail |
|----------------------------------------------|-------|-------|----------------|--------|-----------|
| Laboratory Temperature                       |       | deg C | 20.6 to 22.2   | 21.6   | Pass      |
| Laboratory Relative Humidity                 |       | %     | 10 to 70       | 44     | Pass      |
| Pendulum Speed                               |       | m/s   | 3.55 to 3.75   | 3.73   | Pass      |
| Pendulum Velocity                            | 6 ms  | m/s   | 1.0 to 1.4     | 1.3    | Pass      |
|                                              | 10 ms | m/s   | 1.9 to 2.5     | 2.0    | Pass      |
|                                              | 14 ms | m/s   | 2.8 to 3.5     | 2.8    | Pass      |
| D Plane Rotation                             |       | deg   | 83 to 93       | 84     | Pass      |
| Peak Moment within Deflection Corridor       |       | Nm    | -53.3 to -43.7 | -48.5  | Pass      |
| Negative Moment - Time Curve Decay to -10 Nm |       | ms    | 60.0 to 80.0   | 67     | Pass      |
| Overall Test Results                         |       |       |                |        | Pass      |

David Schoedel  
Laboratory Technician

09/12/2014  
Test Date

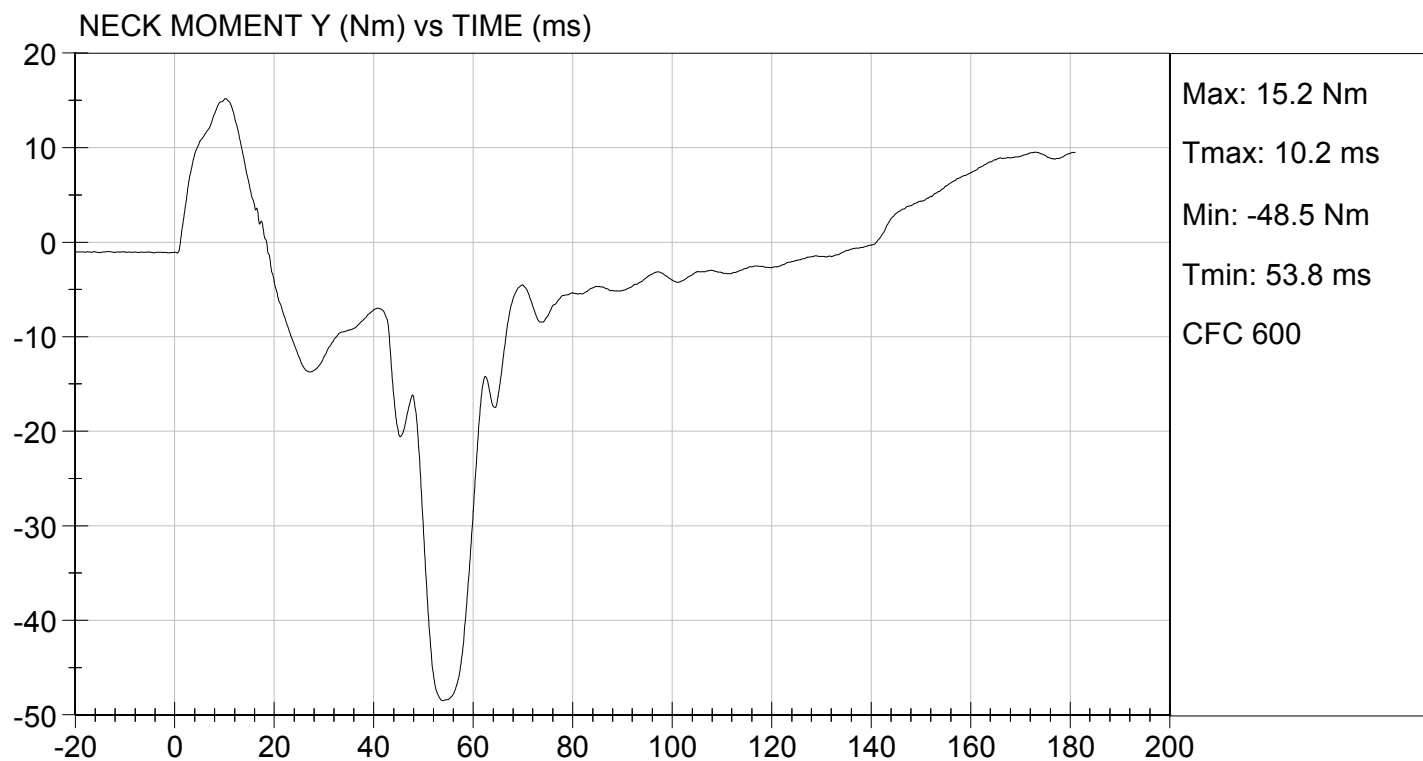
Jeff Leonard  
Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 12.25 ft/s, 3.73 m/s

TEST DATE: 09/12/2014  
TEST #: D143153



**DATA SHEET D6**  
**THORAX IMPACT TEST (572.144) (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 09/12/2014

Technician: David Schoedel

     Pre test calibration  
X Post test calibration verification

Test attempt no. 1 (when successive thorax impact tests are necessary)

X 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))  
X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 11D.

X 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))

|                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>47%</u>    |
| Record the minimum humidity    | <u>43%</u>    |

X 5. Remove the arms.

X 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No damage

     - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.

     - The following repairs or replacement was performed. Record damage.

- X   7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))
- X   8. Level the middle rib both longitudinally and laterally  $\pm 0.5^\circ$ . (572.144(c)(3))
- X   9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.144(c)(3))
- X   10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within  $\pm 2.5$  mm within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X   11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X   12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X   13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X   14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X   15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

- X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

| Parameter*                                              | Specification                                              | Result  |
|---------------------------------------------------------|------------------------------------------------------------|---------|
| Test Probe Speed                                        | $5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$   | 5.9 m/s |
| Chest Compression                                       | $32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$ | 35 mm   |
| Peak force** between 32 and 38 mm chest compression     | $680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$  | 725 N   |
| Peak force** between 12.5 and 32.0 mm chest compression | Peak force $\leq 910 \text{ N}$                            | 715 N   |
| Internal Hysteresis***                                  | $65\% \leq \text{hysteresis} \leq 85\%$                    | 72%     |

\*Time zero is defined as the time of initial contact between the test probe and the chest skin.

\*\*Force = impactor mass x acceleration (572.144(b)(3))

\*\*\*Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

- X 17. Plots of chest compression, pendulum acceleration, pendulum force, and force versus deflection follow this sheet.

David Schoedel  
Signature

09/12/2014  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D:** D143154

| Tested Parameter                              | Units | Specification | Result | Pass/Fail |
|-----------------------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature                        | deg C | 20.6 to 22.2  | 21.6   | Pass      |
| Laboratory Relative Humidity                  | %     | 10 to 70      | 45     | Pass      |
| Probe Velocity                                | m/s   | 5.9 to 6.1    | 5.9    | Pass      |
| Peak Deflection                               | mm    | 32 to 38      | 35     | Pass      |
| Peak Resistive Force w/in Deflection Corridor | N     | 680 to 810    | 725    | Pass      |
| Internal Hysteresis                           | %     | 65 to 85      | 72     | Pass      |
| Max Force 12.5 mm - 32 mm Deflection          | N     | <= 910        | 715    | Pass      |
| Overall Test Results                          |       |               |        | Pass      |

David Schoedel  
Laboratory Technician

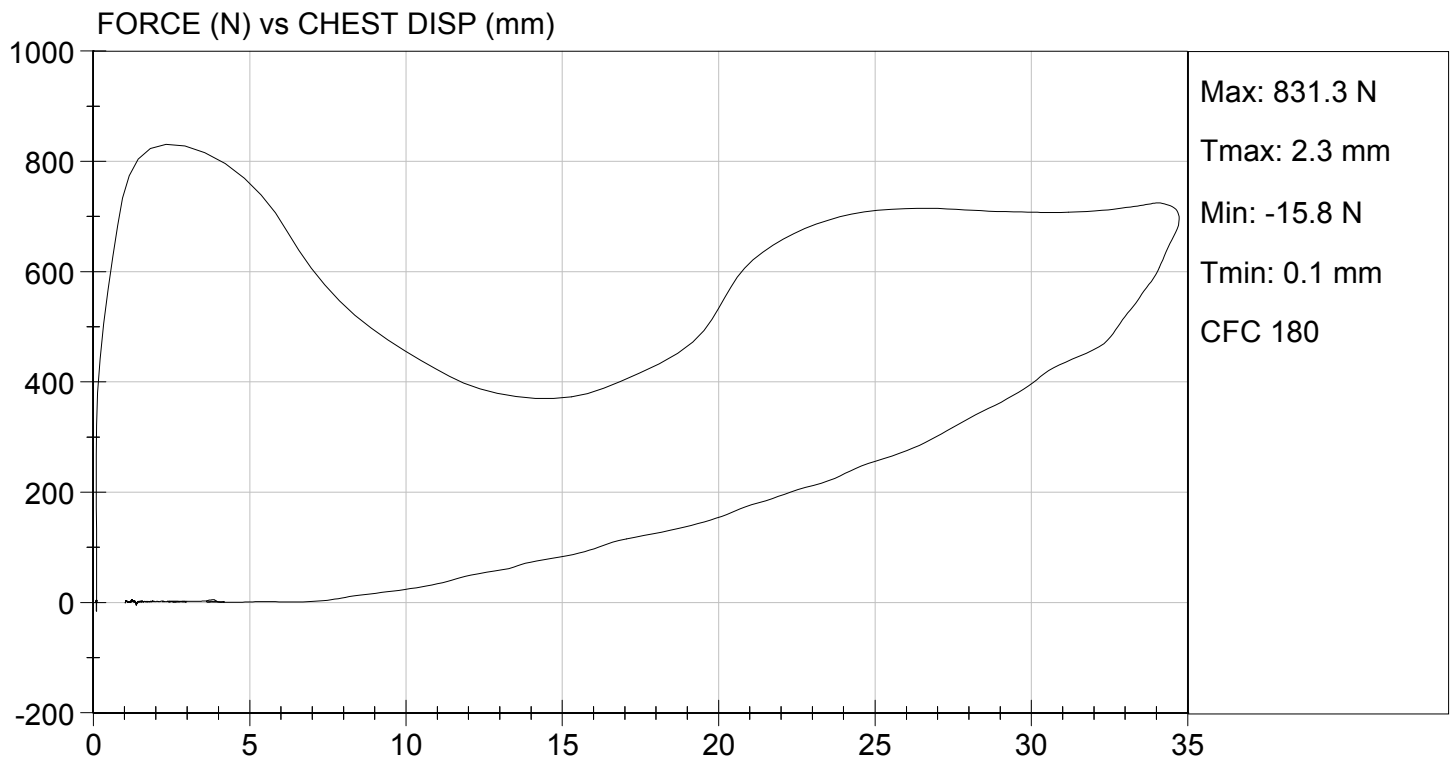
09/12/2014  
Test Date

Jeff Leonard  
Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 19.36 ft/s, 5.90 m/s

TEST DATE: 09/12/2014  
TEST #: D143154



## DATA SHEET D7

## TORSO FLEXION TEST (572.145) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 09/12/2014

Technician: Jessica Gall

|       |                                    |
|-------|------------------------------------|
| _____ | Pre test calibration               |
| X     | Post test calibration verification |

Test attempt no. 1 (when successive torso flexion tests are necessary)

- |              |    |                                                                                                                                                                                                                    |
|--------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>  X  </u> | 1. | It has been at least 30 minutes since the last torso flexion test. (572.146(p))                                                                                                                                    |
|              |    | <u>    X    </u> N/A, ONLY torso flexion test performed                                                                                                                                                            |
| <u>  X  </u> | 2. | The test fixture conforms to the specifications in Figure 13D.                                                                                                                                                     |
| <u>  X  </u> | 3. | The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).                                                                                                                   |
|              |    | <u>    X    </u> with legs below the femurs.                                                                                                                                                                       |
|              |    | <u>          </u> without legs below the femurs.                                                                                                                                                                   |
| <u>  X  </u> | 4. | The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))          |
|              |    | Record the maximum temperature <u>          21.6°C          </u>                                                                                                                                                   |
|              |    | Record the minimum temperature <u>          21.0°C          </u>                                                                                                                                                   |
|              |    | Record the maximum humidity <u>          47%          </u>                                                                                                                                                         |
|              |    | Record the minimum humidity <u>          43%          </u>                                                                                                                                                         |
| <u>  X  </u> | 5. | Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))                 |
| <u>  X  </u> | 6. | Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within ± 1° and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii)) |
| <u>  X  </u> | 7. | Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))                                                                          |
| <u>  X  </u> | 8. | Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))                                                             |

- X   9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between  $0^\circ$  and  $30^\circ \pm 2^\circ$ . The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))
- X   10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near  $0^\circ$ . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
- X   11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))
- X   12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))  
Record reference plane angle (max. allowed  $15^\circ$ )     See Result Table
- X   13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- X   14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between  $0.5^\circ$  and  $1.5^\circ$  per second, until the torso reference plane reaches  $45^\circ \pm 0.5^\circ$  of flexion relative to the vertical transverse plane. (572.145(c)(5))
- X   15. Maintain angle reference plane at  $45^\circ \pm 0.5^\circ$  of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))
- X   16. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- X   17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- X   18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

| Parameter                         | Specification                                                 | Result               |
|-----------------------------------|---------------------------------------------------------------|----------------------|
| Initial ref. plane angle          | Angle $\leq 15^\circ$                                         | $4^\circ$            |
| Torso rotation rate               | $0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$ | $0.6^\circ/\text{s}$ |
| Force at $45^\circ \pm 0.5^\circ$ | $130 \text{ N} \leq \text{force} \leq 180 \text{ N}$          | 165 N                |
| Final ref. plane angle            | Initial ref. plane angle $\pm 10^\circ$                       | $5^\circ$            |

- X   19. A plot of the force versus time follows this sheet.

                    Jessica Hall                      
Signature

                    09/12/2014                      
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D:** D143157

| Tested Parameter             | Units | Specification | Result | Pass/Fail |
|------------------------------|-------|---------------|--------|-----------|
| Laboratory Temperature       | deg C | 18.9 to 25.6  | 21.0   | Pass      |
| Laboratory Relative Humidity | %     | 10 to 70      | 44     | Pass      |
| Initial Angle                | deg   | 0 to 22       | 4      | Pass      |
| Return Angle                 | deg   | 0 to 8        | 5      | Pass      |
| Force at 45 deg              | N     | 130 to 180    | 165    | Pass      |
| Upper Torso Deflection Rate  | deg/s | 0.5 to 1.5    | 0.6    | Pass      |
| Overall Test Results         |       |               |        | Pass      |

Jessica Hall  
Laboratory Technician

Jeff Leonard  
Approved By

09/12/2014  
Test Date

# DATA SHEET D8

## PART 572 INSTRUMENTATION CALIBRATION INFORMATION

| I.D. NO.                              | MANUFACTURER | MODEL NO.           | SERIAL NO. | DATE OF LAST CALIBRATION | DATE OF NEXT CALIBRATION |
|---------------------------------------|--------------|---------------------|------------|--------------------------|--------------------------|
| DUMMY INSTRUMENTATION                 |              |                     |            |                          |                          |
| HEAD ACCELEROMETERS                   |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P79758     | 05/14/2014               | 11/14/2014               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79759     | 05/14/2014               | 11/14/2014               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79761     | 05/14/2014               | 11/14/2014               |
| NECK TRANSDUCER                       | Denton       | 3303                | 184        | 03/20/2014               | 09/20/2014               |
| CHEST ACCELEROMETERS                  |              |                     |            |                          |                          |
| (1) LONGITUDINAL                      | Endevco      | 7264C-2KTZ-2-360M17 | P78269     | 08/26/2014               | 02/26/2015               |
| (2) LATERAL                           | Endevco      | 7264C-2KTZ-2-360M17 | P79852     | 08/26/2014               | 02/26/2015               |
| (3) VERTICAL                          | Endevco      | 7264C-2KTZ-2-360M17 | P79856     | 08/26/2014               | 02/25/2015               |
| CHEST POTENTIOMETER                   | Servo        | 08C1-3179           | 031        | 09/04/2014               | 03/04/2015               |
| FEMUR LOAD CELLS                      |              |                     |            |                          |                          |
| (1) RIGHT FEMUR                       | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| (2) LEFT FEMUR                        | N/A          | N/A                 | N/A        | N/A                      | N/A                      |
| LABORATORY INSTRUMENTATION            |              |                     |            |                          |                          |
| NECK PENDULUM ACCELEROMETER           | Endevco      | 7231C-750           | AGH11      | 08/11/2014               | 02/11/2015               |
| THORAX PENDULUM ACCELEROMETER         | Endevco      | 7264C-2KTZ-2-240    | P83176     | 5/1/2014                 | 11/1/2014                |
| KNEE PENDULUM ACCELEROMETER           | Endevco      | 7264C-2KTZ-2-240    | P80111     | 07/02/2014               | 01/02/2015               |
| NECK ROTATION TRANSDUCER 1 (OPTIONAL) | Spectrol     | 132-0-0-102         | 18         | 04/15/2014               | 10/15/2014               |
| NECK ROTATION TRANSDUCER 2 (OPTIONAL) | Spectrol     | 132-0-0-102         | 23         | 04/15/2014               | 10/15/2014               |

LABORATORY TECHNICIAN: \_\_\_\_\_

*Jessica Hall*

**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 031

Test Date: 09/08-09/10/2014

Technician: Jessica Gall

This check sheet is completed as part of the post test calibration verification.

X Perform general cleaning.

| Dummy Item                  | Inspect for                                                  | Comments | Damage | OK |
|-----------------------------|--------------------------------------------------------------|----------|--------|----|
| Outer skin                  | Gashes, rips, cracks                                         |          |        | X  |
| Head                        | Ballast secure                                               |          |        | X  |
|                             | General appearance                                           |          |        | X  |
| Neck                        | Broken or cracked rubber                                     |          |        | X  |
|                             | Upper neck bracket firmly attached to the lower neck bracket |          |        | X  |
|                             | Looseness at the condyle joint                               |          |        | X  |
|                             | Nodding blocks cracked or out of position                    |          |        | X  |
| Spine                       | Broken or cracks in rubber                                   |          |        | X  |
| Ribs                        | Broken or bent ribs                                          |          |        | X  |
|                             | Broken or bent rib supports                                  |          |        | X  |
|                             | Damping material separated or cracked                        |          |        | X  |
|                             | Rubber bumpers in place                                      |          |        | X  |
| Chest Displacement Assembly | Bent shaft                                                   |          |        | X  |
|                             | Slider arm riding in track                                   |          |        | X  |
| Transducer leads            | Torn cables                                                  |          |        | X  |
| Accelerometer Mountings     | Head mounting secure                                         |          |        | X  |
|                             | Chest mounting secure                                        |          |        | X  |
| Knees                       | Skin condition                                               |          |        | X  |
|                             | Insert (do not remove)                                       |          |        | X  |
|                             | Casting                                                      |          |        | X  |
| Limbs                       | Normal movement and adjustment                               |          |        | X  |
| Knee Sliders                | Wires intact                                                 |          |        | X  |
|                             | Rubber returned to "at rest" position                        |          |        | X  |
| Pelvis                      | Broken                                                       |          |        | X  |
| Other                       |                                                              |          |        | X  |

If upon visual examination, damage is apparent in any of these areas, the appropriate engineer or engineering technician is to be consulted for a decision on repair or replacement of parts.

Repair or Replacement approved by:

Jessica Hall  
Signature

09/12/2014  
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard  
Signature

09/12/2014  
Date